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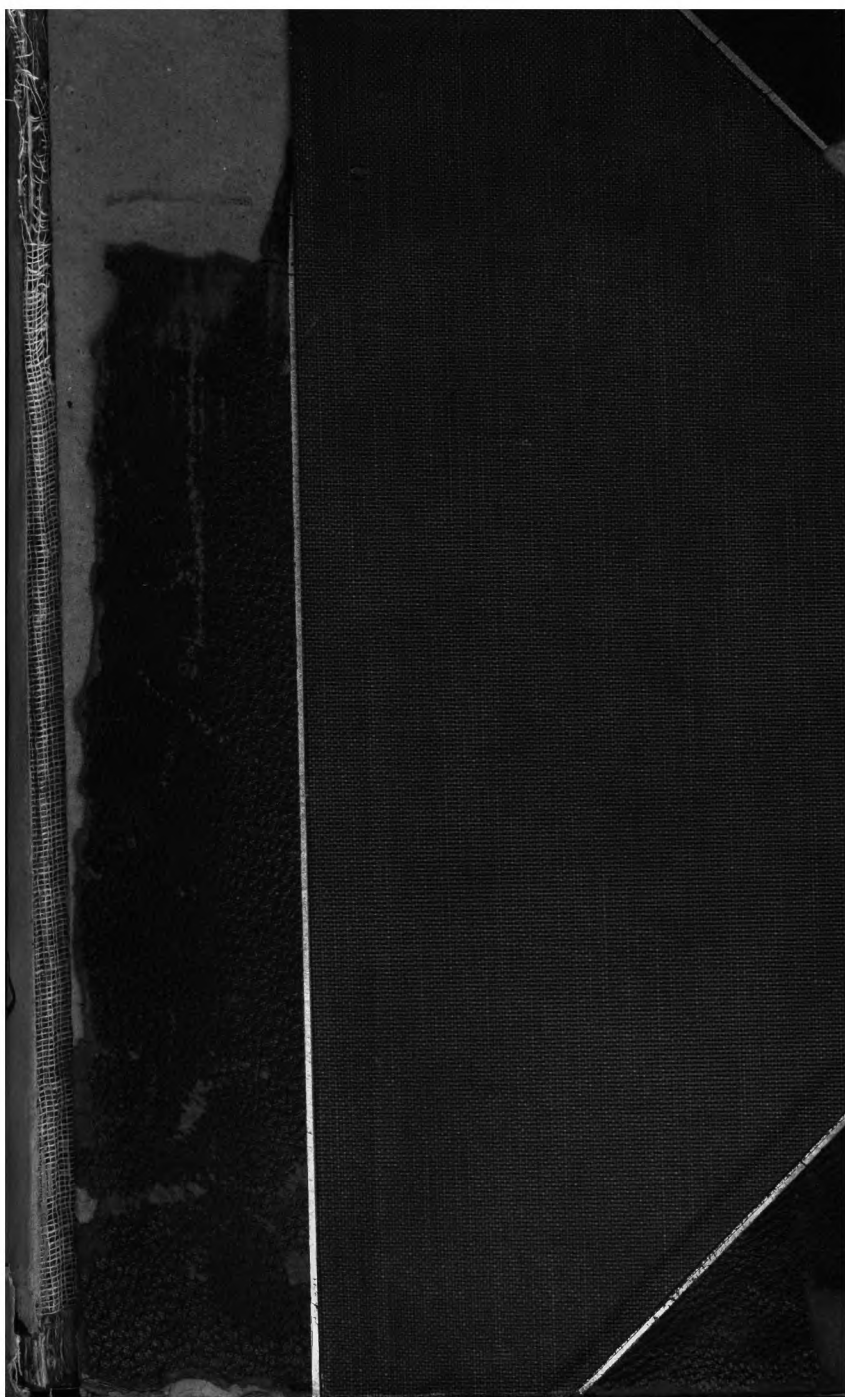
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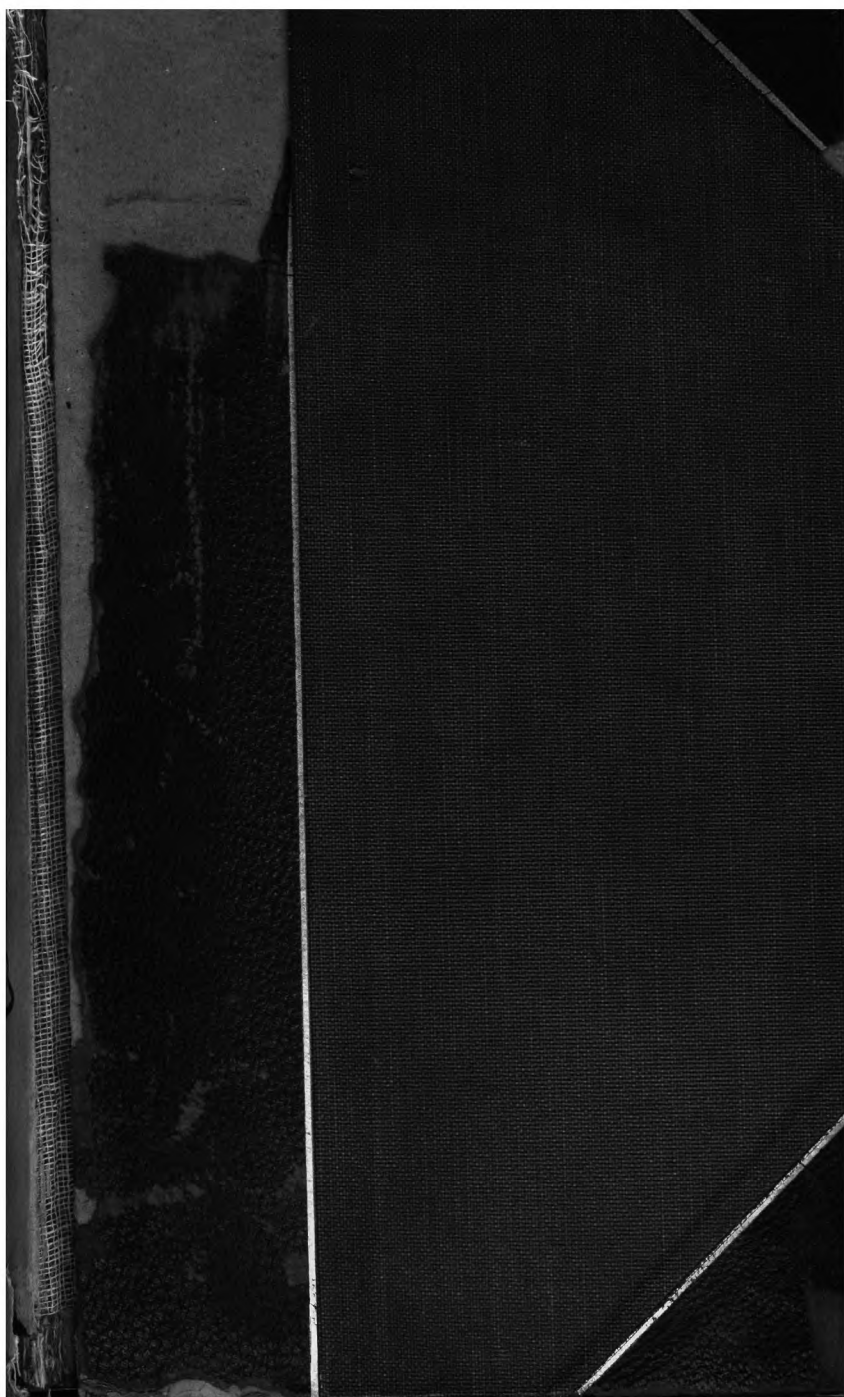
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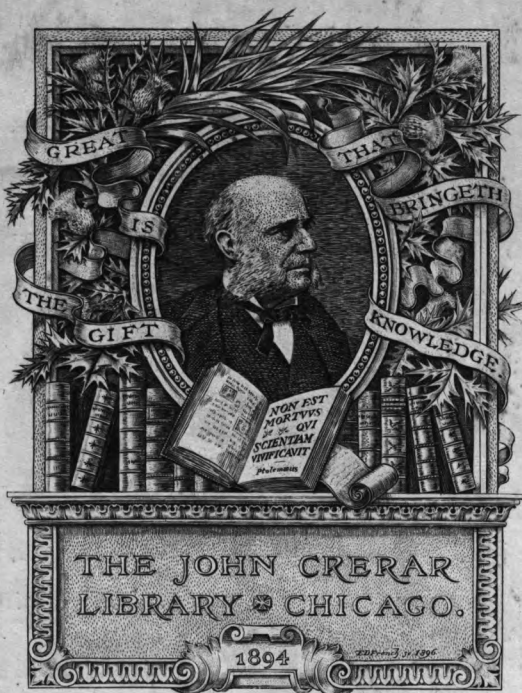




















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LETTUCE  
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TOMATOES  
EGGPLANTS AND PEPPERS  
CUCUMBERS AND SQUASHES  
MELONS  
SWEET CORN  
OKRA, MARTYNIA, AND SWEET HERBS  
ASPARAGUS  
RHUBARB, ARTICHOKEs, AND SEA KALE

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# RAISED PLOT VEGETABLE

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## PREFACE

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The volumes of the International Library of Technology are made up of Instruction Papers, or Sections, comprising the various courses of instruction for students of the International Correspondence Schools. The original manuscript for each Instruction Paper is prepared by a person thoroughly qualified, both technically and by experience, to write with authority on his subject. In many cases the writer is regularly employed elsewhere in practical work and writes for us during spare time. The manuscripts are then carefully edited to make them suitable for correspondence work.

The only qualification for enrolment as a student in these Schools is the ability to read English and to write intelligibly the answers to the Examination Questions. Hence, our students are of all grades of education, and our Instruction Papers are, therefore, written in the simplest possible language so as to make them readily understood by all students. If technical expressions are essential to a thorough understanding of the subject, they are clearly explained when first introduced.

The great majority of our students wish to prepare themselves for advancement in their vocations or to qualify for other and more congenial occupations. Their time for study is usually after the day's work is done and is limited to a few hours each day. Therefore, every effort is made to give them practical and accurate information in clear, concise form, and to make this information include all of the essentials but none of the non-essentials. To effect this result derivations of rules and formulas are usually omitted, but thorough and complete instructions are given regarding how, when, and under what conditions any particular rule, formula, or process should be

applied. Whenever possible one or more examples, such as would be likely to arise in actual practice, together with their solutions, are given for illustration.

As the best way to make a statement, explanation, or description clear is to give a picture or a diagram in connection with it, illustrations are very freely used. These illustrations are especially made by our own Illustrating Department in order to adapt them fully to the requirements of the text. Projection drawings, sectional drawings, outline drawings, perspective drawings, partly shaded or full shaded, are employed, according to which will best produce the desired result. Half-tone engravings are used only in those cases where the general effect is desired rather than the actual details.

In the table of contents that immediately follows are given the titles of the Sections included in this volume, and under each title is listed the main topics discussed. At the end of the volume will be found a complete index, so that quick reference can be made to any subject treated.

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# LETTUCE

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## GENERAL REMARKS

1. Lettuce is the most important of the salad crops and one of the most universally grown and highly profitable of the vegetable crops. Every commercial vegetable grower should make a careful study of the lettuce plant with a view to determining the best methods by which he can produce it for market. Among the many advantages of this plant as a vegetable crop is the fact that it is easily grown and matures very quickly, some of the earliest kinds reaching marketable condition in from 54 to 60 days from the time of seeding in the field, provided the conditions are favorable. Lettuce is also the most important of the vegetable crops grown under glass, and is extensively cultivated in frames both in the spring and in the fall, and in greenhouses during the winter. It is one of the most readily salable crops at all times of the year, but, unfortunately, is also one of the most perishable after cutting.

2. Lettuce is a hardy annual plant with composite flowers. All varieties are supposed to have been derived from the prickly lettuce, which is found in a wild state in Europe, Asia, and Africa. Cos lettuce came originally from the Greek island of Cos in the Levant. Lettuce has been cultivated for more than 2,000 years, and was prized by the Greeks and Romans as a salad. It was first cultivated in England about 1562, but it is not known from whence this lettuce was brought. The wide distribution of the plant since that time and its consequent production in many climates and soils has resulted in the many types and varieties. The popularity of the crop has made it

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of importance to plant breeders generally, and there is now a constant effort to improve varieties and to produce new ones, so that plants suitable for certain soils and certain climatic conditions may be secured.

3. Lettuce seems to be gaining in popularity every year, especially with persons of discriminating taste, due partly to the fact that it can be secured at practically all times of the year, and usually at reasonable prices as compared with the prices for other fresh vegetables out of season. Lettuce is undoubtedly more largely consumed in the northern than in the southern parts of the United States, partly because the plant lends itself to cultivation better in a cool climate than in a warm one, and partly because few gardeners in the South make an effort to produce the crop at all seasons of the year.

4. Although the greater part of the crop is grown by itself, the lettuce plant is one of the best for double cropping, being used rather extensively for planting between other vegetables, such as asparagus, cabbage, celery, etc. Its rank as a profit producer, however, warrants its use in double cropping only where it receives sufficient plant-food, enough space for full development, and can be tilled as often as necessary. Lettuce plants should not be set at random between rows of other vegetables, or between plants in the row.

5. In recent years, lettuce has gained much prominence as a truck crop. The South Atlantic States, particularly Florida, makes a specialty of lettuce production for Northern markets. Some growers plant several acres annually as a succession crop after celery; others plant lettuce to precede tomatoes on the same ground. Lettuce production in Florida has been highly successful on subirrigated land and on land that has a good system of overhead irrigation.

The crop of lettuce from the South is becoming more and more of a factor in the Northern markets, and at times makes great inroads into the profits of the Northern greenhouse lettuce growers. The Southern crops are arranged and managed so that they will be ready for shipment to the Northern markets shortly after the weather has destroyed the last of the outdoor

crops in the North, which, according to the season, will be late in the fall or early in the winter. They are also planted in the proper succession, so that lettuce may be shipped North practically continuously from this time until the spring crops from the frames of the market gardeners of the North are able to supply the needs of the markets. From this, it will be seen that the lettuce grown in the hotbeds of the market gardeners and the outdoor crop of the North has little competition from outside sections, but that the greenhouse lettuce of the North is now meeting with keen competition.

6. Throughout this Section, the cultural directions given are largely for head lettuce. The culture of leaf, or curly, lettuce, however, is very similar to that of head lettuce. Leaf lettuce requires less room in the row and, after coming to maturity, will remain in a marketable condition longer than head lettuce. The quality of leaf lettuce is generally considered to be good, but the plants lack those blanched leaves which are so prized by many users of head lettuce. Leaf lettuce matures somewhat more quickly and generally brings somewhat lower prices than head lettuce in the market. As stated elsewhere, there is no sale for leaf lettuce in some markets, and the character of the demand in any particular market should always be determined before an attempt is made to grow this crop.

In a general way, the methods of production of cos lettuce are about the same as those for the production of head and leaf lettuce. Cos lettuce, however, need be spaced only about 8 inches apart in the row, and toward maturity it is sometimes necessary to tie the plants at the top as endive is tied in order to make certain that the central leaves of the head will be blanched. Cos lettuce is cut, trimmed, and packed in much the same way as head lettuce.

7. **Commercial Importance.**—In 1909, the total value of the lettuce crop was \$1,595,085, produced on 5,489 acres, distributed over 2,178 farms—an average of 2.52 acres per farm. These statistics include only the lettuce grown in patches of 1 acre or more; immense quantities are also grown in smaller patches.

8. Lettuce is raised extensively in the United States. The ten principal states in lettuce production, named in the order of their rank in 1909, are: Florida, New York, Massachusetts, Illinois, California, Louisiana, Ohio, New Jersey, Pennsylvania, and Missouri. South Carolina, North Carolina, and Virginia follow closely. The ten principal states produced more than 87 per cent. of the total crop; the first four produced more than 61 per cent; Florida alone produced more than 21 per cent., and New York produced more than 18 per cent.

9. The average income per acre from lettuce for the United States is more than \$290; in the different states, the average income per acre is: California, \$754; Massachusetts, \$698; Illinois, \$666; Ohio, \$537; New Jersey, \$355; Pennsylvania, \$313; Florida, \$252; New York, \$236; Louisiana, \$183; and Missouri, \$155. Rhode Island on a much smaller acreage has an average income per acre of about \$1,333.

10. **Cost of Production and Income per Acre.** Although the cost of production of any crop naturally varies considerably with different growers, the following estimates of the cost of producing 1 acre of lettuce that have been taken from the experiences of experienced New England lettuce growers will serve as a guide for the beginner:

	MODERATE ESTIMATE	LIBERAL ESTIMATE
Rent of land (value per acre \$50 to \$1,000)	\$ 10.00	\$100.00
Plowing and harrowing.....	4.00	10.00
Seed (1 to 3 pounds).....	1.50	5.00
Marking field and applying fertilizer.....	4.00	10.00
Fertilizer (1,000 to 2,000 pounds).....	25.00	50.00
Stable manure (30 to 60 tons).....	60.00	120.00
Setting out plants.....	12.00	16.00
Cultivation (eight to ten times).....	16.00	30.00
Interest and depreciation on implements..	2.00	5.00
Harvesting.....	35.00	60.00
Packing.....	50.00	75.00
Hauling to station.....	25.00	75.00
Total.....	\$243.50	\$556.00

In some items both estimates are fairly liberal; for example, not more than one-half of the fertilizer and manure applied should be charged to the lettuce crop, as a great deal of it will remain for subsequent crops.

A grower who spends as much money as indicated in the preceding estimates, will expect a yield of about 2,000 to 2,500 dozen heads of marketable lettuce per acre. At an average price in New England of from 15 cents to about 60 cents a dozen heads, this would give an extreme variation of from about \$300 to \$1,500 income per acre; the average income per acre even by progressive market gardeners would seldom amount to as much as the higher estimate.

**11. Uses.**—Lettuce is by far the most popular of all the salad vegetables. It is used alone and in combination with other vegetables. The leaves are also extensively used as a garnish for other salads, and for sliced cold meats. Lettuce is sometimes used in soups; it is also boiled like greens and is equal in quality to spinach. Lettuce that is not desirable for salad purposes can often be boiled and served as greens to advantage; it is suitable for this purpose at any time during its growth up to the time the seed stalks begin to develop.

The juice of the lettuce plant contains a narcotic principle somewhat like opium. Only a very slight trace of this can be found in the juice from a young plant, but the percentage increases with the age of the plant. This narcotic principle, however, does not have the undesirable constipating effects of opium, and a tea prepared by boiling old lettuce leaves is sometimes used for the correction of diarrhea.

**12. Climatic Requirements.**—Lettuce is primarily a cool-weather plant, and it will thrive during the cool parts of the year much better than during the warm parts. The outdoor culture of lettuce in the North is, therefore, comparatively easy early in the spring and late in the fall, but is difficult during the heat of July, August, and the early part of September. Due to the selection and breeding of varieties capable of withstanding the heat, however, in which the tendency to shoot to seed under heat is largely overcome, lettuce can now be

produced outdoors continuously in the North from early in the spring until late in the fall.

Lettuce may be classed as one of the hardy vegetables, as it is fairly resistant to cold. The young plants will stand even lower temperature than cabbage plants without injury. If they are properly hardened off, young lettuce plants can endure without injury a temperature of from 18° to 20° F. This fact makes possible the early planting of lettuce without fear of damage. When they are near maturity, however, the plants will not stand such a low temperature, and may be considerably damaged by a freeze. The damage suffered by mature plants during a freeze depends to some extent on the climatic conditions immediately preceding the low temperature. If the temperature sinks lower gradually, thus hardening off the plants to a certain extent, the plants will stand a much lower temperature than they will if a period of cold weather immediately follows a protracted warm spell. The young lettuce plants can be carried over the winter unprotected in the South, and this is done extensively in the trucking section about Norfolk, Virginia. They can also be brought through the winter outdoors uninjured in the vegetable-growing sections of Long Island, especially if they are covered with a light mulch of straw, or some similar material.

**13.** The climatic conditions of different regions, however, determine to a great extent the time of the year when lettuce can be produced for market to the best advantage, and the larger markets of the country are supplied with lettuce from different sections at different seasons of the year. During the winter months the truckers from the far South, particularly those in Florida, send large quantities of lettuce to Northern markets, and an abundant supply also comes from greenhouses during the winter. A certain quantity of lettuce is also produced in hot-beds and cold frames. Many market gardeners plant to precede the first field planting of the spring with a crop grown under sash and follow the last crop in the fall with another similar crop.

**14. Soils.**—The ideal soil for lettuce is a sandy loam, free from acid, well drained, and well supplied with manure.

The crop will, however, succeed on many kinds of soils, and different kinds and varieties of lettuce will do better on some soils than on others.

Head lettuce is more particular about soil conditions than the other kinds, and will seldom do well except on a sandy soil; a satisfactory crop cannot be produced on a heavy, compact soil. These statements apply to head lettuce grown under glass as well as to the outdoor crop. The Big Boston is the only variety of head lettuce that can be depended on to do well in other than sandy soils or under unfavorable conditions. This is the variety that is most extensively planted on muck soils.

The curly, or leaf, lettuce, particularly the Grand Rapids variety, will succeed on a great variety of soils. This lettuce will succeed in almost any soil that is well supplied with organic matter and that is well drained. This accounts for the extensive production of curly lettuce over such a large area of the country.

Cos lettuce is well adapted for growing on heavy soils and will succeed on clay soils.

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## VARIETIES, SEED, AND PLANT PRODUCTION

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### VARIETIES

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#### GENERAL REMARKS

15. Varieties of lettuce are plentiful but the variety of names are still more numerous, due to the fact that varieties have been indiscriminately named and renamed to the confusion of both seedsmen and growers. In a careful variety test conducted by the United States Department of Agriculture at Washington, D. C., more than 100 distinct varieties of lettuce were found to be listed by American seedsmen under about 300 different names. All these varieties have been listed and described in Bulletin 69 of the Bureau of Plant Industry of the United States Department of Agriculture.

Three distinct types of lettuce are sold in the markets of the United States: (1) *Head lettuce*; (2) *curly*, or *leaf, lettuce*; and (3) *cos lettuce*.

**Head lettuce** is by far the most popular of the three kinds and is therefore the most extensively grown. It is practically the only type that is accepted in large quantities in the markets in the northeastern section of the country. About 75 per cent. of all lettuce grown for market in the field in this country is of the head type.

**Curly, or leaf, lettuce** is grown in many home gardens and to some extent for market in the country west of the central part of New York State, particularly in the late part of the summer, when it is difficult to raise good head lettuce.

**Cos lettuce**, or *romaine*, is a type that grows a long, slender leaf; it is coarse in quality and somewhat hard. It is more highly prized in Europe than in the United States, but there is some demand for it among the foreign population. On the whole, however, its culture is limited.

16. In regard to the classes into which the different varieties of lettuce can be most conveniently divided, and of which a clear conception is necessary before the description of varieties can be understood, Professor W. W. Tracy, of the United States Bureau of Plant Industry, who has specialized on this kind of work, has the following to say, using the edible qualities of the plants and their habits of growth as the basis for the classification:

Cultivated lettuce is known technically as *Lactuca sativa* (Linn.). The species to which this name is given has not been found in a wild state, and it is generally supposed that it has been derived from *Lactuca virosa* (Linn.) or from *Lactuca scariola* (Linn.).

The classes to be made of lettuce are those recognized by most seedsmen and horticultural writers, namely, the *cos*, distinguished by their upright habit, long, loaf-shaped heads, and spatulate leaves; the *butter*, distinguished by their buttery flavor; and the *crisp*, distinguished by their hard, crisp texture. Express Cos and Paris White Cos are good examples of the

cos classes; California Cream Butter, Maximum, Hartford Bronzed Head, and Black-Seeded Tennis Ball, of the butter class; while Green Fringed, Malta, White Star, and Grand Rapids show the characteristics of the crisp class. There is no difficulty in identifying the cos varieties, but certain of the crisp and butter varieties are much alike. The latter are generally more delicately flavored, softer, and more pliable in texture. The crisp varieties are coarser veined and larger ribbed than the butter sorts, but not more so than the cos varieties. Their borders are also more developed than other parts of the leaf and the cotyledons of the young seedlings are generally longer than those of the butter sorts. On account of their much developed borders, they are sometimes called frilled lettuce.

These three classes of lettuce are each again separated into two subclasses. The cos are divided into those which are *self-closing* or comprise kinds which form well-blanching heads without tying up, and the *loose-closing*, or those open sorts which will not form well-blanching heads without tying. Express Cos and Paris White Cos are good examples of the self-closing, and Bath Cos of the loose-closing varieties.

The butter and crisp classes are separated alike into *cabbage-heading* and *bunching*, the former referring to the plants whose leaves overlap one another in such a smooth, regular way as to form a head like a cabbage, and the latter to those whose heads are open, clustered, or bunched in arrangement, or if overlapping one another at all doing so at the heart only, all the outer or visible portions remaining more or less loose-leaved. Hanson and Big Boston are good examples of cabbage-heading varieties, and Early Curled Simpson, Prize Head, and Lancaster of the bunching varieties. Under the latter subclass are embraced all degrees of clustered growth from varieties loose-leaved like an endive and represented by Boston Curled and Green-Fringed to those densely bunched and represented by Black-Seeded Simpson and White Star.

The term "cutting" has been used by a few writers in the United States and by Vilmorin, of France, to embrace only varieties of the former mode of growth, but in this country it is

generally made to include all bunching varieties and is used simply as another name for bunching. Vilmorin has also classified lettuces into *spring*, *summer*, and *winter*, but such a division has little value in a climate like ours and has never been used in this country.

17. The different varieties of lettuce require widely varying lengths of time in which to reach maturity from seed. The varieties are grouped in different ways but the following grouping adopted by Professor Tracy seems to be very satisfactory: (1) *Very early*, including those that require from 54 to 60 days to mature from the sowing of the seed; (2) *early*, 61 to 66 days; (3) *early intermediate*, 67 to 72 days; (4) *intermediate*, 73 to 76 days; *late intermediate*, 77 to 80 days; *late*, 81 to 85 days; *very late*, 86 to 90 days. These figures were based on trials conducted at Washington, D. C., during the spring and autumn months, and presuppose a quick germination, the plants appearing above the surface within 4 days after sowing the seed, and making a good continuous average growth thereafter.

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#### HEAD-LETTUCE VARIETIES

18. The leading market varieties of head lettuce are: *Big Boston*, *Black-Seeded Tennis Ball*, *Salamander*, *California Cream Butter*, *Deacon*, *Mammoth Black-Seeded Butter*, and *Hanson*. In addition to these, there are more than seventy other varieties of lettuce that form heads somewhat like a cabbage head; they are sometimes called *cabbage-heading varieties*, which vary from each other sufficiently to be classed as distinct varieties.

To be suitable for market, a variety of head lettuce should possess the following qualities: Rapid growth; good size; the formation of a distinct and firm head from 4 to 5 inches in diameter and with a well-blanchd center; the outer leaves should be of a bright green color, and the leaves should be tough enough to stand handling without serious injury—that is, the head should possess good shipping qualities; the heads should be slow to run to seed under temporarily unfavorable condi-

tions; and the leaves should be of as good quality as can be obtained without sacrificing the characteristics just named.

**19. Home-Garden Varieties.**—The characteristics of a variety of lettuce that may be suitable for a home garden may be widely different from those just described. The home gardener can, for instance, afford to sacrifice such qualities as firmness of the head, large size, and good shipping qualities for such qualities as crispness, flavor, and tenderness of leaf. The truck grower must have the qualities, such as the three just named, which the home gardener can afford to do without,



FIG. 1

because the most serious difficulty of the truck grower is the getting of his crop to market in good shape and in having it stand up properly until it is sold. The market gardener can afford to sacrifice some of the shipping qualities of lettuce, because he is able to get his product to market soon after it leaves his field. Fortunately for the commercial grower and the consuming public, some of the varieties of best quality also possess the qualities most needed by the lettuce shipper.

Because of their high quality, Black-Seeded Tennis Ball, Salamander, California Cream Butter, and Deacon are desirable varieties for growing in the home garden; also, their high

quality greatly enhances their value for commercial purposes. Two other varieties that are not suitable for market because of their tender quality but that are of excellent quality and are particularly desirable for the home table are Half Century and Hartford Bronzed Head.

**20. Truck-Farm Varieties.**—The two varieties of head lettuce that are commonly considered to be the most desirable for the truck farm are the Big Boston and the California Cream Butter. The second of these is by far the more palatable and is, in fact, a variety of the highest quality known.

**21.** The **Big Boston** lettuce, shown in Fig. 1, sometimes sold as *Giant White Forcing*, *Chesterfield*, and *All Right*, is a



FIG. 2

variety very generally known and is listed by practically all the leading seedsmen. This is probably more largely planted than almost any other variety and is used almost exclusively by the truckers of the South Atlantic and Gulf States for the crop for northern markets. It is also a decided favorite of many market gardeners in the North for the first early and the latest sowings.

This variety is a distinct cabbage-heading variety, as the illustration indicates; the heads are large and are slow to throw up seed stalks, and require from 11 to 12 weeks to reach maturity. When mature, the plant is very compact, as shown in the cross-section of the head in Fig. 2, and the head is large, very

hard, and slightly pointed. The leaves are very broad, comparatively smooth, thick, and rather stiff, and not easily torn. The leaf is of a light, dull-green color, slightly tinged on the border with light brown. The quality of the leaves is poor, but the shipping qualities are excellent. The appearance of the heads is fairly good, but could be improved by the elimination of the brownish border on the edges of the leaves and the presence of a somewhat brighter green color. The seeds are whitish.

**22.** The **California Cream Butter** lettuce, a head of which is shown in Fig. 3, and which is also known as *Philadelphia*

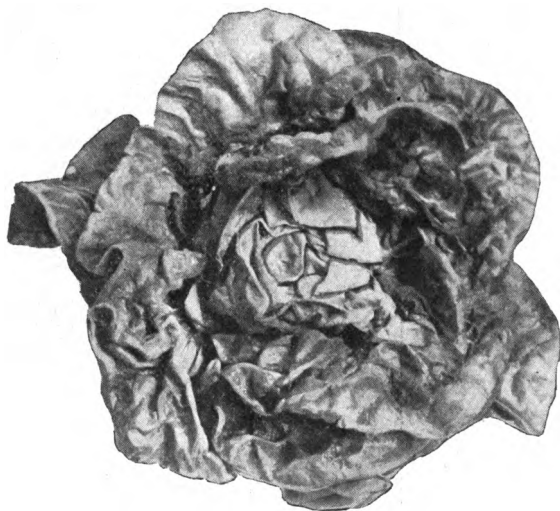


FIG. 3

*Butter*, *Early Spring*, and *Summer Drum Head*, was introduced about 2 years before the *Big Boston* variety, but for some unaccountable reason has not become so generally known or grown as that variety. The plants of this variety are very hardy and will winter over in the field in localities where the temperature does not go below 10° F. This variety is a good one for the summer season and is worthy of a thorough trial in localities where *Big Boston* is the variety most largely planted.

Like the Big Boston, the California Cream Butter variety is a cabbage-heading variety, and is also known as a distinct butter variety. The heads are large, mature in practically the same length of time as the Big Boston, and are equally slow to shoot to seed. The plant is somewhat less compact than that of the Big Boston, but the head is well defined and blanched and round and hard. The leaves are broad, somewhat crumpled and blistered, very thick, and the margins are unbroken. The leaves are of a dark, rich, glossy green, the outside leaves being freely and distinctly spotted with deep brown, but the leaves of the head are free from such markings. The quality is excellent, the leaves being soft, thick, sweet, and buttery. The seeds are blackish or brownish instead of being whitish, like those of the Big Boston. The California Cream Butter variety is a favorite in California and in some parts of the South, but it is not as good a shipper as the Big Boston, and its brown coloring lessens its popularity in certain markets.

**23. Market-Garden Varieties.**—The varieties of head lettuce best suited to the requirements of market gardeners are numerous, but as has been done with varieties for the home garden and truck farms, only a few, including those that are the most desirable from every point of view, are discussed.

**24. The Black-Seeded Tennis Ball** lettuce, a head of which is shown in Fig. 4, and which is also commonly called *All Heart*, *Black-Seeded Butter*, *Black-Seeded Summer*, *Bloomsdale Butter*, *Market Gardeners' Private Stock*, *Long Island Winter*, *Twentieth Century*, and *Satisfaction*, is one of the four most largely grown varieties of lettuce in the United States. It is also one of the oldest varieties and has been known in the United States for more than 50 years. This variety does well in all sections of the country, is a sure header, hardy, and a good shipper and seller, and has been more often renamed than any other variety—a sure sign of its good quality and general adaptability.

The Black-Seeded Tennis Ball is a decided butter variety; it is cabbage-heading and a trifle smaller than the two truck

varieties previously described, the Big Boston and the California Cream Butter; it matures earlier than these, requiring from 10 to 11 weeks to reach full growth; and possesses the undesirable quality of shooting to seed in the summer if the weather is unusually warm. The plant is of compact growth, and the head is well formed, round, firm, and has a well-blanced center. The leaves are broad, much blistered and crumpled, thin, light green in color, and have no brown markings. The quality is excellent, but the thickness and substance of the leaf that is so characteristic of the California Cream Butter is lacking. The seeds are blackish.

**25.** The **Salamander** lettuce is usually listed as a distinct variety, but may just as well be considered with the description



FIG. 4

of the Black-Seeded Tennis Ball, because, in reality, it is a strain of that variety that has been selected for heat resistance—which means for its slowness to shoot to seed when exposed to very hot weather. The main weakness of the Black-Seeded Tennis Ball variety is its quickness to shoot to seed. In appearance and quality, heads of the Salamander are practically identical with heads of the Black-Seeded Tennis Ball, but a good strain of the Salamander, grown side by side

with the parent variety, will head better and give a larger percentage of marketable heads in the heat and bright sunshine of July and August. This quality makes it a much more valuable summer variety than the parent, and really warrants the use of a distinctive name. This variety might possibly with greater exactness be called the Summer Strain of Black-Seeded Tennis Ball were it not for the unwieldy character of the name.

**26.** The **California Cream Butter**, previously described, is a good market garden variety as well as a truck farm variety.



FIG. 5

For a market that objects to lettuce with some brown coloring on the leaf, however, it will not do well. Otherwise, it is eminently satisfactory.

**27.** The **Deacon**, **Big Head**, **Golden Heart**, **Large Drum Head**, **San Francisco Market**, or **St. Louis Butter** lettuce, a head of which is shown in Fig. 5, has been on the market for more than 30 years and is one of the ten most extensively grown varieties in the United States. It is most popular in the large markets of the Mississippi Valley and the West.

This is a butter, cabbage-heading variety, with heads medium large in size, comparing favorably in this respect with Black-Seeded Tennis Ball, and is slow to shoot to seed. The plant is only a fairly compact grower; the head is rather flattened when mature, and although it is not as firm as those of many other varieties, it is well defined and well blanched. The outside leaves and those of the head appear separate when the plant is mature, those on the outside lying almost flat and those in the head standing upright. The leaves are broad, peculiarly smooth, and unusually thick in appearance, but not stiff. The color of the leaves is a peculiar light grayish green and solid. The quality is first class, the flavor is distinctly buttery, and the leaves have considerable substance. The seeds are whitish.

**28.** The **Mammoth Black-Seeded Butter** lettuce also ranks among the ten varieties of principal importance in the United States, but it is popular chiefly in the northern and eastern sections of the country, being especially popular with the gardeners who grow lettuce for the New York City markets.

This is a butter variety, is strictly cabbage-heading, large in size, requires from 10 to 11 weeks to reach maturity, and is rather slow in shooting to seed. The head is not very hard but is well defined and has a well-blanched center. The leaves are broad, much blistered and crumpled, thin, and of much the same character as those of the Black-Seeded Tennis Ball. The color of the leaves is bright green throughout. The leaves are of excellent quality but are rather too thin to be entirely satisfactory.

**29.** The **Hanson** lettuce, known in different localities as *Nonpareil*, *Montreal Market*, *Toronto Market*, *Excelsior*, and *Gardeners' Favorite* has been on the market about 40 years, is one of the three most extensively grown varieties of lettuce, and is listed by almost every seedsman in the country. It succeeds under a great variety of climatic and soil conditions and is a particularly good summer heading variety.

The variety is known as crisp rather than buttery, is strictly cabbage-heading, is one of the largest varieties grown, and is very slow to shoot to seed. The plant is spreading in its habit

of growth, and forms a globular, very hard, well-defined, and well-blanchd head. The leaves are very broad, blistered, crumpled and twisted, thick, stiff, and coarse in appearance. The borders of the leaf are finely frilled, which gives the plant the appearance of curly lettuce. The color of the leaves is light green and solid, and the quality is very good. The seeds are whitish.

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#### CURLY, OR LEAF. LETTUCE VARIETIES

**30.** The curly, or leaf, lettuce finds little or no demand in the markets of the New England States, and very few growers in that section make any attempt to grow it.

In the other markets of the country curly lettuce is in demand to a varying extent. During the months when lettuce is grown under glass, curly lettuce is very abundant in many of these markets, but during the time lettuce can be grown out of doors, head lettuce is always grown to some extent and will be found in most markets along with curly lettuce. A large part of the lettuce offered in the Buffalo, New York, markets at all times of the year is curly lettuce. It is also found in abundant supply in Cleveland, Ohio; Grand Rapids, Michigan; and Chicago, and westward.

Leaf lettuce will reach marketable condition in somewhat less time than head lettuce, can be grown a little closer in the row, and may be marketed through a longer period than can head lettuce. These features naturally make it popular with the grower. Before the culture of leaf lettuce should be undertaken, however, the comparative costs of production should be accurately determined, and the fact of whether or not the market will take leaf lettuce in large quantities and equally as well as head lettuce should be carefully determined. These factors, of course, make an important difference in the net return than can be expected from the two crops.

The principal commercial varieties of leaf lettuce are the *Prize Head*, *Black-Seeded Simpson*, and *Grand Rapids*.

**31.** The **Prize Head** lettuce, shown in Fig. 6, is reputed to be the most largely planted variety of the leaf type of

lettuce in the United States. The variety, however, is planted more in the home garden than elsewhere, and is more commonly found in the West than in the East. It is known as a crisp variety, and is bunching instead of heading. It grows to a large size but is marketable during a long period, and matures in from 10 to 11 weeks. The plant does not go to seed easily, is spreading in its habit of growth, and the leaves are in a somewhat loose cluster, generally rather open at the center. The center is well blanched. The leaves are about as broad as they are long, much blistered and crumpled, and very much frilled at the borders. In the exposed parts of

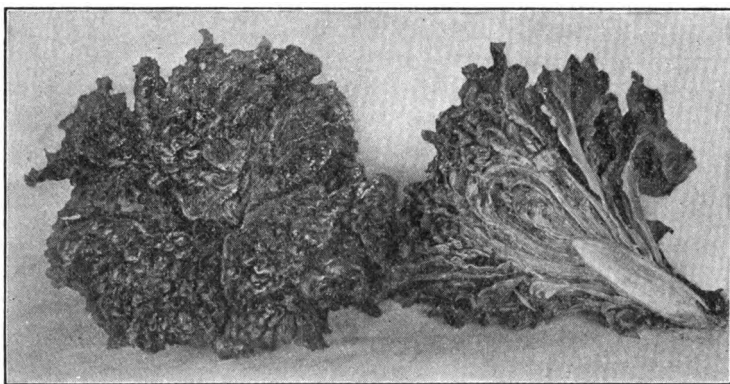


FIG. 6

the plant the color of the leaves is a bright brown, and in the less exposed parts varies to a bright green. The quality of the plant is good, but it is very poor for shipping. The seeds are whitish.

**32. The Black-Seeded Simpson** lettuce is said to be one of the four leading varieties of lettuce grown. The variety is most popular in the vicinity of Detroit, Chicago, and other large cities of that section of the country. It is grown in all sections of the country where leaf lettuce is wanted, but is less popular in the South than elsewhere. No lettuce is more easily grown than this variety, a fact which has been of distinct value in making it a leading variety.

The variety is a decidedly crisp lettuce, and sometimes tends to a cabbage-like growth, the tendency in this direction being more or less developed according to the strain. The plant reaches maturity in about 10 weeks, makes a large growth, is fairly compact, and consists of a firm, well-blanchd V-shaped cluster of leaves. The leaves are very broad, much blistered, crumpled and twisted, thick, stiff, coarse, and have large mid-ribs. The leaves are of a very light-green color. The quality is fair and it is excellent for shipping. As the name indicates, the seeds are blackish.

**33.** The **Grand Rapids** lettuce, shown in Fig. 7, is the favorite variety for the crop that is grown under glass in all

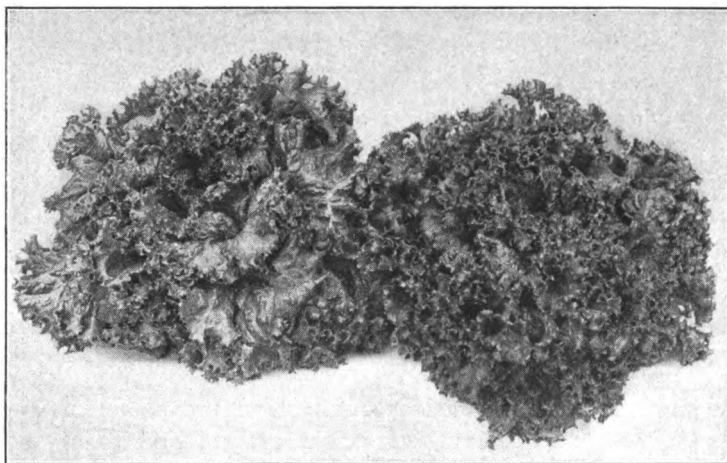


FIG. 7

sections where leaf, or bunch, lettuce is acceptable. This variety is not as successful as desired for outdoor culture, but it is unsurpassed for indoor culture. It has been produced by selection from the Black-Seeded Simpson. Its culture out of doors is not recommended south of latitude 39°.

The Grand Rapids is a crisp variety of the bunching type, requires from 10 to 11 weeks to reach maturity, and is quick to shoot to seed. The mature plant is fairly compact in its habit of growth and forms a loose, rounded cluster of leaves,

which, however, blanch but little. To be fairly compact, the plant must be grown under favorable conditions. The leaves are of about equal length and breadth, much blistered and crumpled, thick, heavy, and have coarse veins. The borders of the leaves are so fringed that the plant looks more like a boquet than an edible vegetable. The quality of the outdoor-grown plants is poor, but the quality of the plants grown under glass is much higher. The seeds are blackish and are difficult to germinate.

#### COS LETTUCE VARIETY

**34.** The cos varieties of lettuce, or romaine, are gaining in popular favor. They have a more distinct flavor and sweetness about them and more substance than other types of lettuce, but apparently they do better under European climatic conditions than in the United States. The demand for this type of lettuce also is limited, and any person who might attempt to raise cos lettuce on the same scale that many growers produce other varieties of lettuce would find the marketing of his crop a serious task.

The leaves of cos lettuce are long and narrow; the plant is an upright grower, and forms a more or less firm center from 6 to 10



FIG. 8

inches high. In order to insure the proper blanching of the central leaves, it is often necessary to tie up the outer leaves of the head. The production of this type of lettuce on a small scale is recommended as a promising experiment. A dozen or more distinct varieties of cos lettuce are known to the trade, but of these the Paris White Cos lettuce is the principal one.

**35.** The **Paris White Cos** lettuce, a head of which is shown in Fig. 8, is the chief variety of the cos lettuce grown in the United States; it is also known under the following names, which are incorrectly used: *Heat Resisting Cos*, *Celery Cos*, *Trianon Cos*. This variety has been listed by American seedsmen for nearly 50 years, and hardly any other variety of the type is grown to any extent in the United States.

Plants of this variety grow a long, large, upright bunch of leaves that may be called self-closing. They mature late in the season and are slow to go to seed. The plant is a compact grower, and, on the young plant, the leaves grow straight and flat; as the plant becomes older, the leaves become somewhat spoon shaped, with the concave side toward the center. This causes the production of a distinctly blanched head. The leaves are thick, coarse, and stiff, and have prominent mid-ribs, but they are crisp, sweet, firm, and of good quality. The color of the leaves is dark green. The seeds are whitish.

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#### SEED AND SEED PRODUCTION

**36.** The greater part of the lettuce seed used in this country, and also a considerable part of that used abroad, is now grown in California. In that state more than 500 acres are devoted to seed production and the total annual production from this area is estimated to be more than 250,000 pounds. One American seed house is reported to have sold as much as 8,000 pounds of one variety of lettuce seed in 1 year. Prior to about 1880 the bulk of the lettuce seed used in the United States came from abroad. The production of lettuce seed in California was begun several years before this date. The remarkable success of the California lettuce seed growers has been due to the superior quality and large size of the seed grown in that state.

The home production of lettuce seed is feasible in almost any locality in which lettuce will do well. The main argument against home production of lettuce seed is the expense involved, but this hardly applies to the production of a small quantity. The first essential of successful production of lettuce seed

lies in the selection of the plants from which seed is to be saved. To do this satisfactorily, the grower must have a clear idea of the characters of the type of lettuce plant he wishes to perpetuate. The characters vary so greatly in different varieties that each variety must be carefully studied by itself. The following factors should always be considered: (1) General appearance of head, (2) earliness of maturity, (3) texture and color of leaf, (4) firmness and shape of head.

The plants for seed production are generally grown in the same way as for market. When only a small quantity is grown for home use, the most convenient location for the seed plants is in one or two rows at one side of the main field of lettuce where they will not be likely to interfere materially with the subsequent cropping of the field after the market crop of lettuce has been removed. The seed plants should be set about the same distances apart as the lettuce for market; they should not be crowded together as is done by some lettuce seed growers. This crowding is sometimes carried to such an extreme that the plants will not form heads. By this means, the production of lettuce seed per acre can naturally be increased, and the time required for securing the crop can also be lessened, but this practice is generally considered to result in the production of inferior seed.

Lettuce does not readily cross-fertilize, the flowers being perfect; that is, possessing both male and female organs, and commonly being self-fertile. Because of this fact, different varieties of lettuce may be planted side by side, or at least within short distances of each other, with little danger of a mixture of varieties.

The source of lettuce seed for a crop of seed lettuce should always be known by the grower. Self-sown, or volunteer, lettuce is common, and inferior seed is sometimes obtained from such crops.

**37.** Lettuce seed plants should be carefully cultivated until they have grown seed stalks and blossomed and the seed has commenced to ripen. At this time the seed stalk will often need to be covered to keep off the birds.

When the seed is nearly mature the stalks should be cut and hung up where they can be thoroughly dried. The seed should then be shaken off and rubbed clean to make them look their best. Lettuce plants are very productive of seed, and a few plants will give enough seed to supply all that any one grower will need. On an average, about 30 to 60 plants will be required to produce 1 pound of seed, and yields of from 700 to 1,400 pounds of seed per acre have been secured. The average yield, of course, is less than 700 pounds. Lettuce seed retails from seed houses at from about \$1.50 to \$2.50 a pound in pound lots.

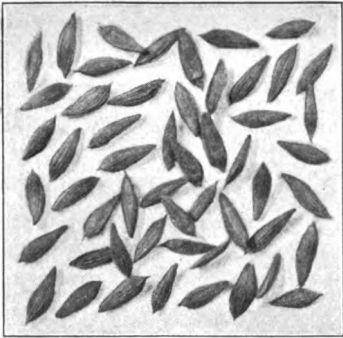


FIG. 9

**38.** Lettuce seed should germinate and the seedlings should break through the ground in from 6 to 8 days. The strength of the seed is such, however, that sometimes under favorable conditions the seed will sprout in about 24 hours, and frequently in from 3 to 4 days. Lettuce seed will not always come up so quickly, however,

especially if planted when the weather is hot and dry. Seed planted during hot, dry weather in September has been known not to sprout until the warm weather of the following spring.

**39.** Lettuce seed of different varieties varies somewhat in color, size, and shape. The color is usually considered to be the most important of these characters and is the one usually mentioned in the descriptions of varieties, being commonly referred to as whitish, blackish, yellowish, and sometimes as brownish; as the colors of the seed are seldom definitely white, black, yellow, or brown, these more definite terms are seldom used; the shades of color of the different seeds also vary considerably with age and with the method of harvesting employed.

The size of the seed varies considerably with the locality in which the seed is grown, although, of course, the care given

to the plants also has much to do with this factor. Ordinarily, California-grown seed is the largest on the market. The seeds of the crisp sorts are also usually larger than the seeds of the butter sorts. Lettuce seed is small as compared with the seed of many other vegetables, about 22,680 being required to weigh 1 ounce; 1 quart of lettuce seed will weigh a little more than  $16\frac{1}{2}$  ounces. A sample of lettuce seed is shown double natural size in Fig. 9.

The shape of lettuce seed is of little consequence. The seeds of some varieties are narrower or more pointed than those of others.

40. Lettuce is a long-lived seed. Authorities estimate that on an average it will retain its power of germination for



FIG. 10

about 5 years and that the extreme limit is about 9 years. Practical lettuce growers, however, prefer to use seed not more than 2 or 3 years old. Lettuce seedlings are shown natural size in Fig. 10.

41. Some lettuce growers estimate that 1 ounce of lettuce seed will be required to produce about 1,000 good lettuce plants, but good growers usually estimate that when the seed is sown in hotbeds, 1 ounce should produce 5,000, or more first-class plants for field setting. When the seed is sown in drills in the field and then thinned so that only a small percentage of the seedlings are allowed to come to maturity, the common estimate is that from 2 to 3 pounds of lettuce seed will be required to sow 1 acre, and that 1 ounce will be required

to sow about 100 feet of row. When the seed is sown in seed-beds and the seedlings transplanted, from 2 to 3 ounces of seed should be sufficient to produce enough plants to set 1 acre.

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### PLANT PRODUCTION

**42.** In the North, the early crop of lettuce is produced by starting the plants in hotbeds or greenhouses and transplanting them in the field, and the late crop is produced from plants that are grown either in a seed-bed in the open and transplanted into the field or from seed that is sown directly in the rows in the field and the plants later thinned to stand at the required distances. In the South, the lettuce plants are handled in much the same way as cabbage plants; that is, they are grown out of doors, the seed being planted in October or later in the fall, in seed-beds, or the seed is planted in the field and the plants allowed to stay there during the winter.

**43.** Two methods of producing plants for the early lettuce crop in the North are followed: (1) The plants are grown in a hotbed and transplanted directly in the field, and (2) the plants are transplanted once in the hotbed before being set in the field. A method that was formerly practiced was to sow the seed in an open seed-bed in the early fall, say in September, transplant the seedlings into cold frames a month or so later, carry them over the winter in cold frames, and set them out early in the spring. This method is now seldom practiced, as it does not produce as good results as the other methods, and more labor is required. The details of the two principal methods of producing lettuce plants for the early crop in the North are as follows:

1. From 5 to 6 weeks previous to the time when the lettuce plants will be required for setting in the field, the seed is sown in a hotbed. The seed-bed should be well prepared and the temperature should be regulated the same as for celery. The seed may be either broadcasted or sown in drills. In either case the seed should be sown thinly and evenly, because the great majority of a good strain of lettuce seed will

germinate, and sufficient room should be provided for the symmetrical development of the plants both below and above ground. When broadcasted, the seed should not be sown thicker than five to ten to the square inch. When sown in drills, the rows should be about 1 inch apart, and from six to ten seeds sown to the inch. The seed should be covered with about  $\frac{1}{16}$  inch of fine sifted soil or clean sand. The seedlings will appear in from 6 to 8 days, and, if the seed is of a good strain, they should grow vigorously. From 4 to 5 weeks later they will be large enough to transplant to the field. This method of transplanting lettuce seedlings directly to the field without a preliminary transplanting is not now considered entirely satisfactory, because the plants so produced are not strong and do not mature as early as those that were transplanted once while in the hotbed.

2. The most satisfactory and also the most popular method of producing lettuce seedlings for field setting is to transplant them once while they are still under glass. In the latitude of New York, the seed is sown from about February 20 to March 1. The first part of the work is the same as that just described, except that the seed should be sown from 6 to 8 weeks before the time for setting in the field, as this method of growing the plants requires more time. The time for transplanting the seedlings under the glass varies somewhat. In order to save time, many growers transplant the lettuce seedlings about 10 days after the seed is sown, but usually they should be somewhat older than this, and sometimes should not be transplanted until about 3 weeks after the seed was sown. Instead of transplanting them any certain number of days after the seed sowing, a better rule to follow is to transplant the seedlings when the second pair of leaves has been developed and the third pair of leaves is just beginning to show. The plants should always be pricked out, or transplanted, by the time 3 weeks have elapsed after the sowing of the seed, or they may grow too spindling for the best results. The plants may be pricked out in the soil of another hotbed, but they can be handled more readily if they are pricked out in flats and then placed in hotbeds as described for cabbage.

In pricking out the lettuce seedlings, they should be spaced at least 2 inches by 2 inches, and some growers claim they get better results by placing them 3 inches by 3 inches apart. The number of sash that will be required for the plants at these different distances will, however, be considerable, and hence the matter should be carefully considered. At 2 inches by 2 inches about 648 plants, or 54 dozen, can be set under a common sash 3 feet by 6 feet; at 3 inches by 3 inches, only about 288 plants, or 24 dozen, can be set in the same space. At either distance the plants should cover the ground in the frames by the time for field setting, and they should be thoroughly but gradually hardened off, as previously described for cabbage plants, before they are set in the field. From 4 to 6 weeks after they are transplanted, the time depending on the distances at which they are set, the lettuce seedlings should cover the ground, should be well rooted, and should be in good enough condition, so that they will be checked but little by the field setting. While in the frames the plants should be cultivated enough to keep down all weeds and to keep a crust from forming on the soil.

The soil for transplanted lettuce plants in a hotbed should be rich in organic matter. A good compost, such as that recommended for cabbage plants, will be suitable, or a good muck soil mixed with sand may be used.

**44.** Mice are particularly fond of lettuce seedlings and will often destroy great quantities unless they can be prevented from entering the hotbed or are destroyed in some way. Unfortunately, mice can enter the ordinary hotbed by burrowing under the frame; hence, some poison must usually be used to kill them. Almost any of the rat poisons commonly sold will be effective. A satisfactory mouse poison may be made at home by soaking corn in strychnine. The mice will usually feed on the corn and be killed.

**45.** The practice of growing lettuce plants for sale in flats is not so attractive from a business standpoint as the production of cabbage plants in flats, because the demand for lettuce plants for setting either in commercial fields or in the home

garden is much less than the demand for cabbage plants. Lettuce plants for setting are more commonly grown by each individual for himself.

46. Lettuce is often grown to maturity in hotbed frames, and in some localities the crop so grown is an important spring crop for the market gardener. It is also largely grown in greenhouses.

47. In the South, lettuce seed can be planted in the open in the fall about 6 to 8 weeks before the time for hard frosts, and by covering the seedlings with a light mulch of straw they can be carried over winter in good shape for setting in the field as early as possible in the spring. This is one of the common methods of producing lettuce plants for the first-early crop. In other cases, the early plants are produced under glass, sometimes in hotbeds and sometimes in cold frames, in the same way as described for the production of lettuce plants under glass in the northern part of the country.

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## PLANTING AND GENERAL OPERATIONS

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### PLANTING

48. The soil should be thoroughly prepared for lettuce, because the crop must be assisted in every possible way to make a quick growth. After plowing, the soil should be harrowed until it is fine and mellow. This often necessitates three, four, or more harrowings.

49. The average-sized varieties of head lettuce are grown about 12 inches apart each way in good soils, and a row is left vacant every 6 feet in order to facilitate the work of harvesting. If the seedlings are grown in a seed-bed, they are transplanted 12 inches apart in the field; if the seed is sown in the field, the seedlings are thinned to stand that far apart. Some growers prefer to have their plants stand 14 inches apart each way in order to provide more room for cultivation.

In some of the trucking sections, as at Norfolk, Virginia, lettuce is set or thinned to stand 10 inches apart each way, and every sixth row across the field is left vacant.

On poor soils, lettuce is sometimes planted as far apart as 18 inches by 18 inches, and occasionally as far apart as 24 inches by 24 inches.

The number of seedlings that can be planted per acre will vary materially at these different distances for planting. At 10 inches by 10 inches, with every sixth row omitted, about 52,270 plants can be set per acre; at 12 inches by 12 inches, with every sixth row omitted, about 36,300 plants; at 14 inches by 14 inches, with every sixth row omitted, about 26,670 plants; at 18 inches by 18 inches, without omitting any rows, about 19,370 plants; and at 24 inches by 24 inches, without omitting any rows, about 10,890 plants.

In home gardens, lettuce seed may be sown in rows 12 inches apart and the plants thinned gradually. At the first thinning the plants may be thinned to stand about 4 inches apart. At the second thinning, the plants are thinned to stand 12 inches apart; the plants taken out at this thinning will be large enough to eat.

**50.** A crop of lettuce on almost every truck farm or market garden should be planted in successive lots, so that the crop can be harvested over a fairly long space of time. Otherwise, some loss may be suffered before all the crop can be sent to market. The time that should elapse between plantings will vary with the locality and with the time of year the crop is being set out. The extent of the separate plantings will depend on the market.

In the latitude of New York City, the sowings of lettuce used in the field should be made from 3 weeks to 1 week apart. Early in the spring, when the rate of growth of the plants is not so rapid as later, the seedings should be about 3 weeks apart. Later, the seedings may be made about 1 week apart. The same thing is true of the sowing of seed in the seed-bed for the production of lettuce plants for setting. Hence, in the latitude of New York, the first seeding in the field is made about

the first week in April, or as early as the ground can be put in good condition; the next seeding should be made about the last week in the month, or about May 1; the next seeding should be made about 2 weeks later; the next should be made in 10 days; and other seedings should be made at intervals of 10 days until July 1; from then on until August 10, sowings of seed about 1 week apart will give the best results; after August 10 there will be but a slight chance of securing a good crop of lettuce from seed sown in the open.

The dates for the sowing of lettuce seed will vary with the latitude. In the latitude of Philadelphia, lettuce seed can be sown about March 10; in the latitude of Washington, D. C., about March 1; around Atlanta, Georgia, about February 10; and in Florida, it may be sown all through the winter.

**51.** The dates for the setting of lettuce plants in the field in different sections of the country are as follows:

In the latitude of New York City, well-hardened lettuce plants may be set in the field as early as April 1, if the soil can be put in condition for them by that date. Marketable lettuce from these plants should be secured by the latter part of May or the first part of June. Sometimes lettuce is planted in this latitude as early as the middle of March. A succession of lettuce can be secured by sowing a second lot of seed at about the same time that the first lot of plants are set in the field. The crop from this sowing should be ready for market about 2 or 3 weeks later than from the plants that were set first. Successive plantings of seed should follow at fairly regular intervals in order to make sure of a proper succession of plants for market. The intervals between the seedings should be varied according to the variety, the season, the extent of the plantings, and other factors directly under the control of the grower. Some of these factors are as follows: The soil should be in good condition; this means that it should be of uniform fertility and texture. An abundance of well-rotted stable manure should be applied, and it should be well distributed throughout the soil. The quality of the seed should be of the best. The seeding should be uniform. When such

details are skilfully attended to, the crop will quickly reach a marketable size, the plants will reach maturity evenly, and the harvesting can be quickly done.

In the neighborhood of Lansing, Michigan, lettuce is set in the field about the first week in May.

In the trucking section of Norfolk, Virginia, the growers commonly set their lettuce plants either in September or in January.

In Georgia, most of the lettuce that is sent to Northern markets is set during September.

**52.** The depth of sowing lettuce seed in the field should be varied from spring to fall, in different soils, and according to the weather conditions. When an abundant and assured supply of moisture is present, shallow seeding should be practiced, but if for any reason the moisture supply is not abundant, as in times of drought, deep seeding will give the best results. Unsatisfactory results with lettuce seed have been traced to a lack of attention to the depth of planting.

When sown where there is an abundance of moisture, lettuce seed is covered with from  $\frac{1}{16}$  to  $\frac{1}{4}$  inch of fine soil, the first thickness of soil for a covering being used at the time of the first sowing in the spring, or where the seed can be artificially watered. At the time of this first sowing in the spring, the seed is barely covered, because at this time moisture is abundant, and the sun will be able to warm up only the surface of the soil quickly; if the seed are planted deeply at this time, the heat of the sun will not penetrate to them readily, because of the excessive moisture normally present.

For the sowings that are made from the latter part of April to June 1, the seed should be covered to a depth of about  $\frac{1}{4}$  inch. Later in the season, especially if the weather is dry, the planting of lettuce seed at a depth of even  $\frac{1}{2}$  inch is permissible and this depth is often better than more shallow planting, because more moisture can be secured at the greater depth.

**53.** Lettuce seedlings that are grown from seed sown in rows in the field should be thinned about 2 to 3 weeks after seeding and before they have begun to crowd, or the plants may grow too spindling for the best results. The cost of thin-

ning can be materially lessened by sowing them properly. Contrary to the rule for the sowing of most vegetable seeds, lettuce seed should be sown thinly, usually not more than four or five seed to the foot of row, if such a thin sowing can be properly done and the soil is in good tilth. When sown thus thinly, the thinning of the plants in the row can be delayed until the extra plants have reached the best size for transplanting, as previously described in the discussion of the methods of producing lettuce plants for field setting; that is, the plants should be allowed to develop two or three pairs of leaves and a good root system, and should *hug* the ground, or grow stockily with short stems rather than with long, spindling stems. If these plants are lifted from the rows and set in rows in another field, the same as plants that are grown especially for transplanting, the production of plants will be very economical, because the plants that are transplanted cannot be figured as costing much, if anything.

54. The transplanting of lettuce in the field can be accomplished to best advantage by gangs of three, composed of two men to do the actual work of setting and a boy to carry and drop plants for them. The details of planting this vegetable are much the same as those described for cabbage and similar plants. Lettuce plants are commonly set by hand, and a dibble is employed to aid in the work. In some cases, where the plants are large and the common round dibble does not make large enough holes, a trowel or a flat dibble is better.

55. Among many lettuce growers the subject of rotation receives very little attention, the crop being planted on different fields as the needs of the moment demand. Usually, however, lettuce should not succeed lettuce on the same ground in the same season, unless the matter cannot be avoided. The best practice is to follow or precede a crop of lettuce with a crop of a different nature, either a root crop or a seed crop. The fact that some soils are cropped with lettuce almost continuously for a considerable length of time should not lead to the assumption that this practice can be followed on all soils without danger of loss.

### GENERAL OPERATIONS

**56. Cultivation.**—In order to preserve the moisture in the soil and to keep the soil well opened up, frequent cultivation is necessary. A good deal of this can be done with wheel and slide hoes, but some hand hoeing will usually be necessary, and, if the land is at all weedy, a certain amount of hand weeding between the plants in the row will be required. The growing of lettuce on weedy land, however, especially if the crop is grown from seed sown in the field, is expensive, on account of the extra weeding, and should not often be attempted.

**57. Irrigation.**—Lettuce is one of the vegetable crops that will show the best results under irrigation, especially when the water can be readily and frequently applied, as is the case when an overhead system of irrigation is available. Under irrigation a lettuce crop can be brought to maturity more quickly and can be produced of better quality than without the artificial application of water. Irrigation makes possible the rapid and unchecked growth of the plant. This not only brings the crop to a marketable condition early but makes the leaves crisp and tender and of the highest quality. By bringing the crop to a quick maturity, time is also saved and the ground can be used to advantage for other crops.

Irrigation immediately after the plants have been set will provide sufficient moisture so that they will gain a good foothold on the soil and be in a condition to start a vigorous growth. From this time until the plants cover the ground fairly well the question of irrigation is largely dependent on the rainfall; irrigation should be used to supplement rainfall so that the soil will be kept continually moist. At the time the plants have practically covered the ground, however, the ground should be thoroughly drenched. Preferably, this should be done at night or during a dull day, when the sun is not shining brightly. If the water is applied in the form of a spray, the plants will not be injured; injury sometimes results from a heavy irrigation by other methods. This irrigation will hasten the growth of the plants and will usually provide all the moisture necessary to

mature the plants and produce a crop of fine quality. Some growers gain the false impression that irrigation will take the place of cultivation. This, however, is not the case. Frequent and thorough cultivation is always essential.

**58. Fertilization.**—The fertilization of lettuce should always be conducted with the idea of securing an extremely rapid growth of the plant, as only by this means can crisp leaves of high quality be produced. To secure such growth, an abundant supply of plant-food in an available form must be present, and the soil must contain a large proportion of humus.

On most soils some high-grade commercial fertilizer will be needed to supply at least a part of the plant-food. From 1,000 to 2,000 pounds of this will commonly be required, and it should be broadcasted before the plants are set in the field. In some cases the application of two or three top dressings of from 150 to 200 pounds of nitrate of soda per acre each may be given with advantage. The first of these top dressings should be applied after the plants have secured a good foothold in the soil, and the others should be applied at intervals of 10 days or 2 weeks. The forcing of lettuce with nitrate of soda should not, however, be overdone, because lettuce that is forced too much with this material, especially if it is applied shortly before the lettuce is cut, will not stand up well in the markets. The application of nitrate of soda to this crop requires considerable experience before it can be done with the best results. The quantities of all commercial fertilizers used will, to a great extent, be dependent on the quantities of stable manure applied.

**59.** To get the best results from lettuce, the soil must contain an abundant supply of humus. In market gardens near the larger cities, the supply of humus is kept up by the application of large quantities of stable manure; sometimes as much as 60 to 80 tons of well-rotted manure is applied with profitable results. With such an application of well-rotted manure, no commercial fertilizer will commonly be needed.

The manuring of land for lettuce should be done at a time when there is an abundance of moisture, but the time of appli-

cation is not so important if the land can be readily irrigated. The application of the quantity of manure just recommended will be so heavy that it often has to be raked into the furrow ahead of the plow. Thorough tillage after the plowing in of the manure will usually serve to mix the manure well enough with the soil, to get the whole mass in good condition, but on the lighter soils irrigation will also be needed, because the manure will require large quantities of moisture.

60. The lettuce truck grower, however, who is situated a long distance from a large city, can seldom secure manure in sufficient quantities or at a low enough price to warrant the application of any such quantities. The success of the Southern lettuce truck grower is commonly said to be largely dependent on his ability properly to supply his soil with sufficient humus, as commercial fertilizers alone will not successfully produce a crop year after year. Most truckers that are too far from a large city to secure large quantities of manure economically must practice a system of farming whereby they are able to give each field a respite from truck growing at least once in 2 or 3 years, in order to be able to stock it with humus by green manuring. Cowpeas, soybeans, vetch, and crimson clover are suitable crops for this purpose.

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## PRODUCTION OF LETTUCE IN HOTBEDS

61. The production of lettuce in hotbeds and cold frames is a very important part of the early spring work on many market gardens and on some truck farms. The production of lettuce in greenhouses, as practiced during the winter, is a separate business.

The lettuce crop grown in hotbeds and cold frames goes into the market when the first signs of spring are evident, when there is a demand for something fresh and green. At this time fresh, crisp lettuce usually brings a high price. In the North, the growing of lettuce in hotbeds for the March and early April markets is usually too expensive to prove profitable, but the crop that is ready for sale from about April 15 to May 15

can be raised from transplanting time without a great deal of heat, and still without much risk of injury by severe weather.

**62.** The seed for this crop should be planted about 70 days previous to the time that it will be needed for market. This would commonly be between February 10 and 20. A good hotbed is the first essential, and sufficient heat will be required to carry the crop for about 50 days. If properly managed, about 1 foot of good heating manure should do this, and only a very few sash will be required to produce enough plants to set a comparatively large area.

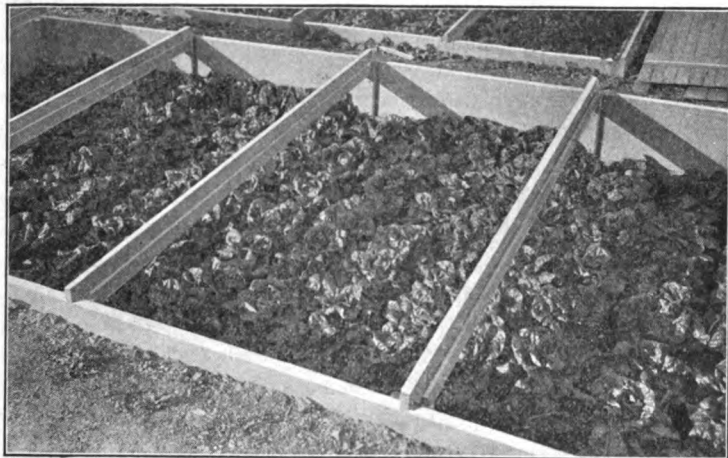


FIG. 11

The growing of the young plants is very similar to the methods of growing seedlings for field planting, previously described. The seed should be sown rather sparsely in rows about 2 inches apart. When the seedlings have reached a suitable size; that is, about the time the third pair of leaves is beginning to develop, the plants should be pricked out in another hotbed about 2 inches by 2 inches apart; this should be done before the plants begin to crowd. At these distances, a sash will accommodate about 648 plants. By the time the plants have grown sufficiently to cover the ground, a second transplanting will be necessary, and this time should be spaced about

8 inches by 8 inches, at which distance they are allowed to remain until they are ready to cut. At this spacing, a hot-bed sash will contain a trifle more than forty lettuce plants. Hence, more than sixteen sash will be required to receive the lettuce plants from a sash in which they are planted 2 inches by 2 inches apart. A hotbed filled with Black-Seeded Tennis Ball lettuce is shown in Fig. 11.

**63.** Double cropping can be successfully practiced in the latter part of the growth of the lettuce in frames in the spring in this way. Several crops may be used. A row of radishes may be planted between each two rows of lettuce, at the time of the second transplanting of the lettuce, and the radishes will be ready for harvesting before the lettuce plants begin to crowd for space. Beets also are suitable for intercropping in the frames. A single beet plant may be set at the center of each of the spaces between the lettuce plants and, as the temperature requirements of lettuce and beets are almost identical, the beets will do well. The beets are allowed to remain in the bed until after the lettuce is harvested, and they soon reach a size suitable for bunching.

About 3 dozen marketable lettuce heads should be secured from the forty plants commonly set under one sash, and if a return of \$2 is secured from these a fair profit should be shown. The income can be increased somewhat by intercropping the lettuce with radishes or beets; about 50 cents' worth of radishes or beets should be grown between lettuce plants under a sash.

**64.** After the lettuce and other crops are harvested from the hotbed, a crop of cucumbers may be grown to good advantage in the frame, or the frame may be used for the protection of some tender plant, such as eggplant, for 4 or 6 weeks. If this is done, the full benefit can be derived from the hotbed.

The fall crop of lettuce that is produced in hotbeds is of much less importance than the spring crop. This is due to the fact that conditions grow more and more adverse to quick growth as the winter approaches. At this time the sash is used to best advantage to mature plants that would otherwise be destroyed by severe weather.

## INSECT PESTS AND INJURIES

65. The insect pests that make lettuce their principal source of food supply are few, and seldom do they do much damage. The main damage to lettuce is done by a number of the leaf-eating insects, but these ordinarily attack lettuce only when their favorite food supply is short. Some of these insects are the **Harlequin cabbage worm**, **grasshoppers**, and, more infrequently, the **common cabbage worm** and the **cabbage plusia**. All of these insects have been previously described. Lettuce is also sometimes attacked by **aphids**, but they more commonly do damage to lettuce under glass than to the field crop. The **root aphid** is, however, sometimes troublesome. **Cutworms** often work serious injury on newly-set lettuce plants, and should be controlled as previously described.

As the use of poisonous insecticides on lettuce is not advisable, because they must necessarily be applied to the edible part of the vegetable, the best way to avoid damage from the leaf-eating insects is to see that the great majority, at least, are killed on their favorite food plants. This will reduce the number that will be left free to attack lettuce.

The aphid may be controlled by a heavy application of lime to the soil, and a proper rotation of crops, so that lettuce does not, at least, follow lettuce on the same ground in successive years. Tobacco dust sprinkled on the ground around the plants and dusted on the leaves will also help to control the aphids that feed on the leaves, and it will not render the plant unfit for food. Lettuce heads dusted with tobacco dust should, however, be thoroughly washed before being sent to market.

66. Diseases that do serious damage to lettuce in the field are practically unknown. A fungous disease that causes **lettuce drop** will destroy a plant here and there in a field, and, at times when weather conditions are exceptionally favorable to its development, this disease may do enough damage

to be serious. Few growers, however, who keep their plants growing rapidly find that this disease bothers their crops much. This fungous disease is more serious on lettuce grown under glass than on the crop grown outdoors. Heavy applications of lime and a proper rotation of crops will prevent this disease from making any serious headway in the field.

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## HARVESTING AND MARKETING

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### HARVESTING

67. To bring the best returns, a crop of lettuce should be harvested at the proper time and in the proper manner. The time of day lettuce is cut, for instance, has an important bearing on its quality. It should not be cut when wilted, as in the heat of the day, for under such circumstances it will not regain the crispness and quality that it would have had if it had been cut while crisp and full of water. Lettuce should also be cut at the proper stage of growth. Head lettuce is ready for market when the leaves have grown together in the middle to make a fairly solid head with a blanched center. Like cabbage, lettuce will sometimes reach a stage when the head will have developed to its limit, after which decay will set in or the growth will proceed in the direction of the production of seed.

The size and firmness of the head is largely a characteristic of the variety, as is also the length of time the plant will remain at its point of full development without running to seed. Climatic and soil conditions also affect this tendency to go to seed. At a time when the heat is excessive, as in the months of July and August, the tendency to develop seed stalks is greatly stimulated, and for this reason, the production of head lettuce at this time is particularly difficult. A lack of moisture in the soil, and a deficiency in fertility will also tend to induce the growth of seed stalks. Excessive drought, followed by a heavy wetting will almost surely send the greater part of the plants in a crop of head lettuce to seed.

68. The manner of harvesting lettuce is of first importance, because, unless the proper care is exercised in this work, the quantity of marketable lettuce secured will be reduced and the quality impaired. The best time and way of harvesting lettuce can be learned only by experience. Hence, the importance of having experienced men for this work cannot be overemphasized.

The following practice in harvesting lettuce has been followed to good advantage:

Harvesting gangs of three, including one man and two boys, are used in this work. The man does the cutting and the boys carry the lettuce away. A good cutter can keep two boys busy. The lettuce is cut with a case knife, or with a broad-bladed knife that curves back to a point, and the root is severed about 1 inch below the ground. As a plant is cut, the cutter turns it over and leaves it lying in the row upside down with the stub of the root upwards. In this position, the cut heads can be easily distinguished from the uncut ones, and the root stub serves as a handle for picking up.

The pickers should follow the cutter closely, so that the lettuce will not have an opportunity to wilt. They must handle it carefully, as head lettuce is easily broken and bruised. The pickers should always pick a head up by the root stub and place it in the box or basket, which they carry, with the root end up. If a head is turned the other side up, the brittle leaves will tend to break from the stem and the appearance of the plant will be injured. There is a knack in handling head lettuce, which can be acquired only by practice; when this is acquired, the work can be done rapidly without bruising the product.

As fast as the receptacles are filled they are carried to the edge of the field and are collected by a man with a wagon.

## MARKETING

### PREPARATION FOR MARKET

**69.** The method of handling lettuce from the time it is cut in the field until it is offered for sale has an important bearing on the attractiveness of its appearance. As previously explained, careful handling is necessary to prevent bruising. Lettuce will also quickly perish if exposed to the wind and sun for any length of time after cutting, and will decay very rapidly in the heat of the summer. Hence, it should be kept cool as much as possible, and should be washed and packed only a few hours before being taken to market. If this is done the leaves will be crisp and bright when offered for sale. If shipped during hot weather from distant points, icing is necessary.

**70. Trimming and Washing.**—As soon as the crop is gathered from the rows and placed at the sides of the field,

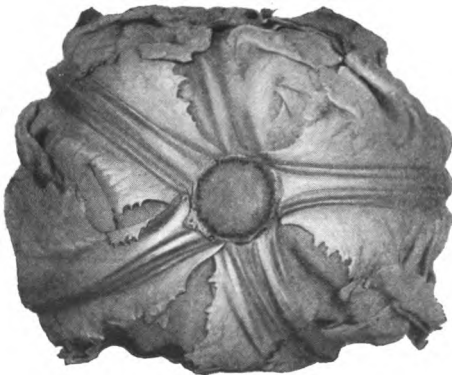


FIG. 12

it is taken to a packing shed. In localities where the shipments are made to distant points, only a rough trimming is given, the outer injured leaves being broken off, and usually the lettuce is not washed. When the lettuce is grown by a market gardener for a local market, however, careful trimming

and washing is necessary. The trimming consists in removing all injured and decayed leaves by breaking them off at the root stock and in cutting off the root almost even with the base of the remaining leaves. The base of a properly trimmed head is shown in Fig. 12.

**71.** The washing is done to improve the attractiveness of the head and to make it appear bright and clean in the market. This is necessary, because particles of soil will usually adhere more or less to the heads as they are brought from the field. The person doing the washing places two heads of lettuce in a tub of water with the root down, places a hand on each head, pushes the heads down under water, and turns the heads over all in one operation. The lettuce heads immediately rise to the top. Then the plants are grasped with the root end up, one plant in each hand, and gently soused about without lifting them from the water, until any soil that may be between the leaves has been washed out. The object of placing the head in the water as just described is to prevent the breaking off of the outside leaves. By this means the loose outer leaves are gotten under water before the heads are moved about. If a lettuce head were placed head end down in the water at the beginning the other leaves would be pushed up and out and many would be cracked or broken off. After the heads have been sufficiently rinsed, they should be lifted from the water upside down, shaken gently to dislodge the excess of water from between the leaves, and packed into boxes or baskets.

In cases where the lettuce is exceptionally dirty, as it is likely to be if harvested soon after a beating rain, rinsing in a second water may be advisable. If this is necessary, the first washer usually places the lettuce heads in a second tub, root end down, and a second man does the second rinsing; this is usually more economical of time than to have one man do the two rinsings.

**72. Packing.**—The New England lettuce growers commonly pack their head lettuce in the so-called New England bushel box, which measures 18 in.  $\times$  18 in.  $\times$  8 in. and contains about 25 per cent. more than a bushel. This will hold  $1\frac{1}{2}$  dozen lettuce heads of the fancy, or first, grade, packed in two layers of nine each. The heads are packed inverted with the root end up, and the heads in the top layers are placed directly over those below.

Lettuce that is somewhat smaller than that in the fancy, or first, grade, is packed 2 dozen to the box, 1 dozen in each

layer, the heads packed three one way and four the other in each layer.

New England growers who take particular pains in packing, line lettuce boxes with paper. White paper is preferable. The cost of the paper should not be more than  $\frac{1}{2}$  cent a box. By using the paper, the lettuce will be protected from the dirt that will commonly be found in all second-hand wooden vegetable packages, such as the common bushel box usually is, and the outer leaves of the lettuce heads will not be bruised so easily against the smooth surface of the paper as they will against the board sides of the box.

**73.** The great majority of the truck growers who ship to distant markets commonly pack lettuce in half-barrel

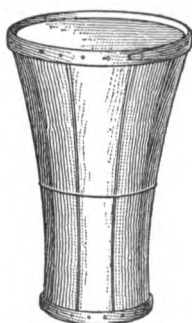


FIG. 13



FIG. 14

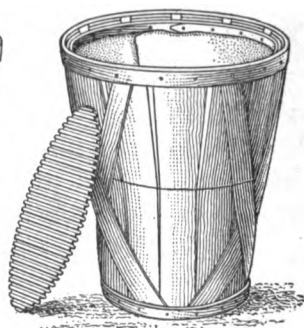


FIG. 15

hampers, or baskets, holding about 3 dozen good-sized heads. Two kinds of lettuce hampers that are in common use by truck growers in the South for shipping lettuce to the New York markets are shown in Figs. 13 and 14. The lettuce is packed into the hampers without being washed, and with little or no trimming, rushed to the railroad station and packed as quickly as possible into refrigerator cars, and shipped to northern commission men.

Some lettuce growers use a heavy paper lining for the half-barrel hampers and put a corrugated paper heading like that shown in Fig. 15, on top of the lettuce and inside of the wooden lid; the common slat lid shown in Fig. 14 is one used on top

of the corrugated heading. The advantages of shipping lettuce in such a package is that much bruising is avoided, and that the heads are to a certain extent protected from being frozen; if, however, they are exposed to a low temperature for a long time, freezing will occur.

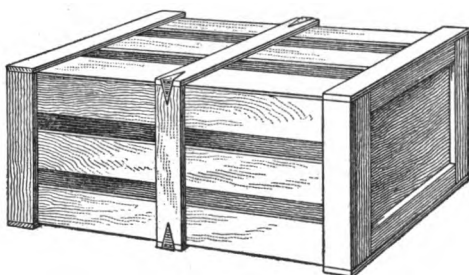


FIG. 16

74. A slatted crate that is used for packing lettuce in some of the trucking sections is shown in Fig. 16. This is 20 inches long,  $16\frac{1}{2}$  inches wide, and  $8\frac{1}{2}$  inches deep, inside measurements, and will hold about 2 dozen heads. This crate is constructed of light material and is popular in some markets because it is a gift package, a thing which the New England bushel box is not, and does not have to be returned to the grower.

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#### SELLING

75. The marketing of lettuce naturally depends very much on the local conditions in the market in which the product is to be sold. When it is grown by the trucker at a distance from the market, the main effort is to bring the bulk of the crop to a marketable condition slightly before the main crop of the locality is ready for market, and a succession of lettuce is not so important, although it is often grown.

The market gardener who supplies a local market, on the other hand, must have a regular daily or semiweekly or weekly supply for his trade. He rarely finds a demand for large quantities of lettuce in any one day; the demand is usually distributed over many days, and hence the plantings should be so made that some lettuce will always be ready for harvesting at regular intervals during the season. In some of the larger markets supplied by market gardeners, the importance of a continuous supply is not so important; in such a case, so much

pains need not be taken to have the successive plantings reach marketable size within a few days of each other.

**76.** Two factors that enter into the marketing of lettuce by the market gardener are: (1) The approximate quantity of lettuce that the trade will consume in a given time, and (2) the average percentage of heads in a planting that can be brought to a marketable condition. Both of these factors are likely to vary widely, and make it difficult to determine in advance the exact cost of production of a crop, and the net profit that may be reasonably expected from it. Only by careful work and observation in his own locality and markets can the market gardener arrive at a satisfactory conclusion on these matters. Much of the net profit from lettuce depends on the correctness with which these factors are determined.

**77. Prices of Lettuce.**—Lettuce is a crop that is found in the markets every month in the year and is considered more as a necessity than as a luxury, but the price is subject to wide variations. The continuous supply in Northern markets is maintained by the outdoor grown crops, the crops grown under glass, and the crops from the South. The fluctuations in prices are due partly to the supply and demand and partly to the quality of the product offered. In times of a shortage, inferior heads of lettuce, commonly known as *light* heads, will find a ready market at good prices, but when there is an abundant supply in the market, lettuce must be heavy, clean, and well put up to find a sale.

Lettuce commonly comes into the New York markets in bushel baskets, or hampers, but is sometimes also sold in these markets in barrels, cases, and by the dozen.

The variations in the prices of lettuce are wide in every month, and also vary considerably from month to month. The higher average prices are generally secured during December, January, February, March, and April, or during the winter and early spring months. The lowest average prices are commonly received during June, July, and August, and reach their lowest point in July; during these months the supply from the outdoor grown crop is most abundant; the prices show some

improvement during the fall months. Formerly, the prices for the crop grown under glass during the fall, winter, and early spring were uniformly high, but the keen competition of recent years and the shipment of large quantities of lettuce from the South into Northern markets has resulted in times of glut and low prices, such conditions sometimes extending over most of a season.

Table I shows the extreme and average low and high prices per bushel basket, or hamper, in the New York markets for

**TABLE I**  
**PRICES OF LETTUCE IN THE NEW YORK MARKETS**

Month	Per Bushel Basket, or Hamper			
	Extreme Prices		Average Prices	
	Low	High	Low	High
January.....	\$.25	\$4.00	\$.57	\$3.28
February.....	.50	5.00	.86	3.60
March.....	.25	5.00	.73	3.63
April.....	.50	5.00	.60	3.13
May.....	.25	3.00	.39	1.85
June.....	.15	2.00	.33	1.00
July.....	.15	1.25	.17	.90
August.....	.10	2.00	.26	1.29
September.....	.10	2.50	.44	1.63
October.....	.15	2.25	.31	1.28
November.....	.10	4.00	.38	2.25
December.....	.10	4.00	.29	3.55

the 10 years from 1903 to 1912, inclusive. These figures are based on the average prices on the first and fifteenth of each month for the decade in question. The information in this table will serve as a guide in marketing lettuce, as it indicates when, on an average, the best prices can be secured. By determining the cost of producing a crop for maturity at different

times of the year, the best time for marketing so as to secure the greatest net profit can be estimated. Land that is planted to lettuce that must be sold at the lowest prices of the year might often be devoted to other crops with greater profit to the grower.

The prices received for outdoor grown lettuce also vary within wide limits in most local markets. At times the wholesale prices in small markets are as low as 5 cents a dozen heads, and at other times as high as \$1 a dozen heads may be realized. As a rule, from 30 to 40 cents a dozen heads should be considered a fair average selling price for lettuce in a local market. At these prices, the crop should be a very profitable one, provided the yield is good; that is, if about 75 per cent. or more of the heads are marketable.

# MISCELLANEOUS SALAD CROPS

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## ENDIVE

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### GENERAL REMARKS

1. **Endive**, sometimes rather loosely called *escarole*, a name that should more properly be applied to the Broad-Leaved Batavian endive, is a native of China and Japan and the East Indies. Like a number of other vegetables, endive is more extensively cultivated in Europe than in the United States. In America it is used largely by foreign-born persons who were familiar with it in their home countries, although it is also occasionally found in hotels and restaurants. Endive is not a staple crop, and cannot be sold at all in three-fourths of the stores of the country; it can be profitably produced only when the market demand for it is certain. In the North, endive is typically a late summer or fall crop; in the South, it is a fall and winter crop. It may fit in well in some gardens at a time when the production of good lettuce is difficult.

2. As commonly grown, the endive plant is an annual and is hardy to frost. The leaves are numerous and large; the main varietal differences are based on the character of the leaf, some being curled, or frilled, and others being rather flat and broad. The seed stalk grows to a height of about 2 feet and generally produces blue flowers.

When blanched, the leaves are used for salads or for garnishing, and when green they are cooked like greens, or used in soups and stews. Unless they are blanched, the leaves are inclined to be rather tough and bitter.

3. As compared with many other salad crops, endive has not been of great commercial importance in the United States, although it is now increasing in value. In 1909, the only states reporting the commercial production of the vegetable were Massachusetts, Illinois, and New York; the bulk of the crop was produced in Massachusetts. The total value of the crop was reported as \$1,918, and was raised on 22 acres, distributed among nine farms. In Massachusetts, the average income per acre was nearly \$150.

4. The production of salad crops other than lettuce and celery is not an extensive business in the United States, although the industry is growing. The total value of the salad crops other than those two just mentioned in the United States in 1909 was \$40,338, raised on 186 acres, distributed among 87 farms. Of this crop, New York and Pennsylvania together produced more than 80 per cent., due largely to the large European-born population in those states. The other states in which these salads are produced commercially are Virginia, New Jersey, Georgia, South Carolina, and North Carolina.

5. **Soil.**—Endive thrives to best advantage on a strong, medium loam or somewhat lighter soil, if it is well supplied with organic matter. Any soil that will do for lettuce, will be suitable for endive, because endive is not nearly so sensitive to soil conditions as lettuce. As a rapid growth of the plant is essential for producing tender leaves, a plentiful supply of moisture should be present in the soil.

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## VARIETIES, SEED, AND SEED PRODUCTION

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### VARIETIES

6. The varieties of endive may be grouped into two general classes, consisting of those with curled, or fringed, leaves, and those with broad leaves. The Large Green Curled is the most important commercial variety of the first class, although the White Curled and the Giant Fringed, or Oyster, endive are also

promising. The Broad-Leaved Batavian is the principal variety of the broad-leaved class.

7. The **Large Green Curled** endive, a plant of which is shown in Fig. 1, is an excellent, hardy variety. The leaves are long, attractively curled, and popular for salads.

8. The **White Curled** endive is similar to the Large Green Curled, except that the leaves are of a light, golden color, and

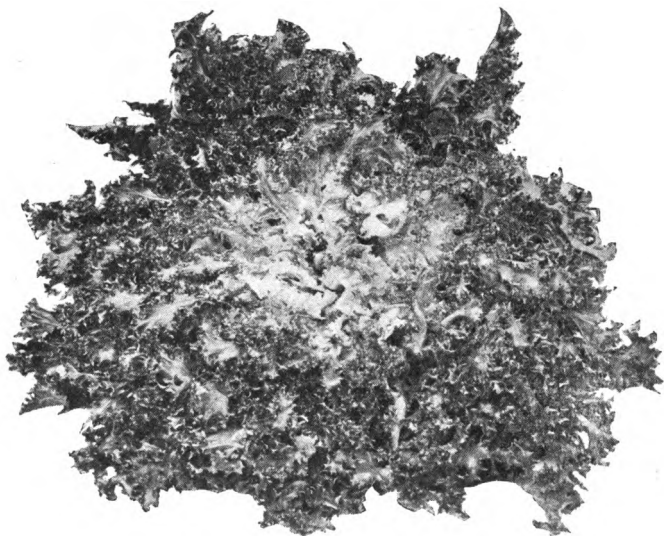


FIG. 1

do not have to be tied up in order to become blanched for table use.

9. The **Giant Fringed**, or *Oyster*, endive is also similar to the Large Green Curled, but the plants grow to a larger size and the leaves are longer. This variety is considered to be worthy of a thorough trial.

10. The **Broad-Leaved Batavian** endive, a plant of which is shown in Fig. 2, and which, especially in the South, is sometimes called *escarole*, is much larger in size than the fringed

sorts, and the leaves do not have any fringing on them. The leaves are broad, thick, rounded at the ends, and slightly



FIG. 2

wrinkled. The leaves of this variety are largely used as greens, being cooked like spinach, and are also used in stews and soups. The leaves are used to some extent raw in salads.

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#### SEED AND SEED PRODUCTION

11. The endive plant is naturally a biennial, although the marketable product is produced in one season. The seed is largely raised in Europe and most of the American supply comes from this source. Its production at home is seldom considered to be worth the trouble and expense.

To produce seed in the South, some of the best plants may be allowed to remain in the ground until about February. To economize space, they may then be transplanted to stand about 18 inches apart each way. In the North, the plants will have to be stored, preferably in a cold frame, unshaded, and for this reason the production of endive seed in the North is not so satisfactory as in the South.

The seed stalks should be supported by being tied to stakes, and the seed pods should be gathered as soon as they show

signs of ripening. The pods should be thoroughly dried on a cloth, thrashed out, and stored in paper bags.

12. Endive seed is fairly small, about 18,000 weighing 1 ounce; 1 quart of the seed weighs about 12 ounces. A sample of Giant Fringed, or Oyster, endive seed is shown natural size in Fig. 3.

Endive seed is long lived, retaining its power of germination for an average of about 10 years, and the extreme limit is much longer. Commercially, however, seed more than 3 or 4 years old is seldom used. Endive seed germinates quickly, in from 5 to 10 days. A few endive seedlings are shown natural size in Fig. 4.



FIG. 3

To be considered high grade, endive seed should be about 99 per cent. pure and about 85 per cent. of it should germinate.

At the usual distances for planting in drills, from 7 to 9 pounds of endive seed will be required for sowing 1 acre, and 1 ounce



FIG. 4

is estimated to be required for sowing about 100 feet of row, although it will usually go much farther than this, some growers claiming that it will do for 400 feet. In pound lots, endive seed retails for about \$1.25 to \$1.50 a pound.

### PLANTING AND GENERAL MANAGEMENT

**13. Planting.**—The time of planting endive will vary with the locality. In the North, where the vegetable is usually grown for fall and winter use, the seed should be sown during July or August. If, however, an early crop is desired, the plants may be started under glass like lettuce plants, and then set outdoors in the field as soon as the ground can be prepared in the spring. In the South, where the plants are grown largely for fall and winter use, the seed is commonly sown during August and September.

Two methods of producing the crop are generally practiced: (1) The seed is sown in the field where the mature plants are to be produced, (2) the seed is sown in a seed-bed and the seedlings are transplanted in the field when they have attained the size at which lettuce seedlings are transplanted.

The plants usually require from 8 to 12 weeks to reach a marketable size, although when skilfully handled and properly fed they can frequently be brought to a good size in from 40 to 50 days. They grow to better advantage during the cool weather of the fall months than during the hot summer weather.

**14.** When the seed is sown in the field, the rows should be spaced about 12 inches apart. The seeding should be rather thin, because the seed has good germinating power and the seedlings are strong growing, usually appearing above ground in from 5 to 10 days after the sowing of the seed. About 3 weeks after the sowing of the seed, or when the seedlings are about 2 inches high, the plants should be thinned the proper distance apart in the row. Most gardeners prefer to thin the plants 12 inches apart, or so that they stand 12 inches apart each way, but others claim they get better results by thinning only to 6 or 8 inches apart in the row; the character of the soil will have an important influence on this point.

**15.** The plants that are taken out during the thinning, if properly handled, may be successfully transplanted in another place. When this is done the seedlings should be taken up

with as little injury to the root system as possible, the leaves should be trimmed back slightly, and the plants set in moist earth and watered occasionally until they become well established.

**16. Cultivation.**—The cultivation for endive should be frequent and shallow, and should be similar to that for lettuce. The ground should be kept free from weeds, and some hand hoeing in the rows may be necessary to accomplish this.

**17. Fertilization.**—To force a quick, desirable, tender growth of the endive leaves, the plant-food in the soil must be in a quickly-available form, and large quantities of well-decayed. organic matter are necessary to provide the means for holding water. For these reasons, the application of about 30 or 40 tons of well-rotted stable manure per acre to the soil shortly previous to the time of seeding or setting is usually advisable. On strong soils this will ordinarily supply all the needed plant-food.

If the plants at any time during their growth show a need for more nitrogen, top dressings of nitrate of soda, at the rate of 150 to 200 pounds to the acre should be made. No more than two such top dressings will be needed on suitable soil.

**18. Blanching.**—All endive that is intended for salads or for garnishing should be blanched, or whitened. This process makes the leaves of a more attractive appearance, removes the bitter taste that the dark green leaves have, and makes the leaves more tender. Endive leaves that are intended for cooking, as in stews and soups, are not usually blanched.

The blanching process should be started about 12 weeks, or 3 months, after the seed is sown, or when the plants have begun to grow stocky and to have a well-developed heart. The blanching process will take from 2 to 3 weeks. In order that there will be a succession of blanched plants ready for marketing when desired, the blanching process should be started on a certain number of plants at regular intervals of a few days.

The blanching can be done by almost any means that will exclude the light from the leaves and at the same time prevent moisture from getting into the heart. It is important to keep

the inside leaves dry, because if moisture is allowed at the heart with the leaves closed over it, rot will soon develop. Hence, the work of blanching should always be started on a dry day. Leaves that are frosted will also rot during blanching. The plants should not be blanched in larger quantities than can be readily disposed of, because when blanched, the leaves are so soft and tender that they will decay rapidly and cannot be held for a market.

19. The blanching of endive is accomplished in many ways. Commercially, the common method is to bring the outside leaves up over the heart of the plant and to tie the tips with raffia or string. The low-growing curled sorts can often be satisfactorily blanched by banking them up with earth, as for celery, but this is not as certain to produce good blanching as to tie them up. Because of its higher and looser growth, the Broad-Leaved Batavian endive can be blanched only by being tied up. In sandy soils some growers cover the plants completely with sand as soon as they are tied up; this effectively excludes the light, but it adds to the cost of blanching.

When raised in a small way, endive may also be readily blanched by the use of drain tile, with the upper end closed, inverted flower pots with the hole in the bottom stopped up, boards, or any other device that will exclude the light and not impart a flavor to the plant. Leaves and straw are sometimes thrown over the plants for blanching.

20. In the North, blanched endive can be secured for some time during the winter by lifting the plants from the field with soil about the roots and resetting them in a vegetable pit, shaded cold frame, cellar, or other similar place. When handled in this way, the plants should be watered occasionally, but not too much, or decay may set in. In the South, endive is hardy enough to stay out of doors all winter, and heads that are tied up in the fall can be pulled as desired during the cold weather. There is, of course, a limit to the length of time that the plants can be kept before decay will set in on the blanched leaves. The fact that blanching is a much slower process in winter

than in the warmer weather of the fall, makes the chance of losing plants in winter less serious.

**21. Insect Pests and Injuries.**—No insect pests or fungous diseases of importance that are especially injurious to endive have as yet made their appearance.

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### HARVESTING, STORAGE, AND MARKETING

**22.** As soon as a plant is well blanched it should be almost immediately harvested. This is accomplished by cutting the tap root with a sharp knife about 1 inch below the surface of the ground. This will sever the tap root about  $\frac{1}{2}$  inch below the point where the leaves begin to come out. The plants should then be trimmed by breaking off any dirty or injured leaves clean at the root stalk. After this the plants should be washed, although when the crop is grown in sandy soil and is to be shipped long distances, washing is often not done. Endive that is to be shipped by rail will carry better if the heads are tied up before they are packed. The heads are usually packed in crates like those used for lettuce, from 2 to 3 dozen heads being placed in a crate.

**23.** The only practical method of storing endive is to lift the plants from the field and set them in some suitable place like a vegetable pit, cellar, or cold frame. This has been discussed under the head of blanching.

**24.** In local markets, endive is usually sold by the dozen heads, and the price received for it is usually on a par with that for lettuce at the same season; the demand for endive, however, is much less than that for lettuce. In some of the larger markets endive is sold by the crate, but in the New York wholesale markets it is more commonly sold by the pound, although occasionally it is quoted there by the barrel. The New York market is mentioned in particular, because it is the largest market in the country.

In the New York markets the price for endive is much more steady than the price for many more staple vegetables. For

the six years from 1907 to 1912, inclusive, the wholesale prices for endive in the New York markets varied from 11 cents to 18 cents a pound, and from \$1.25 to \$2 a barrel; the average price was probably from 12 to 14 cents a pound. As endive is a perishable product, this indicates that there was an active demand for all the endive that was offered.

Prior to 1907, little endive was offered for sale in the New York wholesale markets, and only from 1910 on has the vegetable been offered with any degree of regularity. It is now quoted regularly in the markets during December, January, February, March, April, and occasionally in May and November.

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## CHICORY

**25. Chicory, or succory,** is a native of Europe, but is now extensively found in America, where it is common as a weed, is the leading adulterant of coffee, and is used as a salad and as a pot herb. Chicory is a root crop, is cultivated like other root crops, such as carrots, parsnips, and salsify, and is used as a salad, as a pot herb, and as a root. Three well-known salads are produced from chicory: (1) **Witloof chicory**, or **French endive**, which consists of a fairly solid bunch of leaves, and is produced under soil or under stable manure; (2) **Barbe de Capucin**, which consists of small, loose, blanched leaves that are sent out from the roots in darkness; and (3) the common blanched chicory. The first two forms are by far the most important, and are very popular in Europe, particularly in France.

As a pot herb, chicory leaves are about the equal of dandelion leaves. For use as a pot herb the leaves are cut when they are 6 to 8 inches long, boiled in two or more waters to remove the bitter taste, and served like spinach. The young, and tender roots of chicory are sometimes boiled and served like young carrots, but they have never become popular as a vegetable when served in this way. The roots are used as an adulterant of coffee; when used for this purpose, they are sliced, evaporated, and roasted.

**26. Varieties.**—There are no well-defined varieties of chicory, although the few kinds that are in existence are

sometimes grouped as field varieties and garden varieties. Very few of the varieties, however, will continue true to type, as a definite variety should. The **Magdeburg**, the **Brunswick**, and the **Schlesische** are the principal varieties grown as a field crop. The **Magdeburg** is the variety that is by far the more generally grown; a plant of this that has gone to seed is shown in Fig. 5. The **Witloof** chicory or French endive, as it is commonly called in America, the **Red Italian**, the **Broad Leaved**, and the **Curled Leaved** are the main varieties of garden chicory. The **Witloof** is the most common of these in America; a plant of this is shown in Fig. 6. The salad that is sold in the market under the name of **Witloof** chicory, or French endive, derives its name from the **Witloof** variety, but it can be produced from all varieties.



FIG. 5

**27. Seed and Seed Production.** — Chicory seed is of fair size but rather light; about 20,000 weigh 1 ounce; 1 quart weighs about 14 ounces. Chicory seed is shown natural size in Fig. 7.

Chicory seed is long lived; it retains its power of germination for an average of about 8 years, and the extreme limit is more than 10 years; seed older than 2 or 3 years, however, is seldom used. Chicory seed germinates in about 6 to 10 days. A few chicory seedlings are shown natural size in Fig. 8.

At the usual distances for planting, from 2 to 4 pounds of chicory seed will be required for sowing 1 acre, and 1 ounce of seed will be enough to sow about 100 feet of drill. In pound lots, chicory seed retails at about \$2.50 a pound.

**28. Soils.**—Chicory is cultivated very much like carrots, parsnips, and salsify, and succeeds well under similar conditions.



FIG. 6

It will grow to good advantage on all medium soils that will produce the staple crops and that are free from stones; chicory is not adapted to culture on very heavy clay soils, on the light sandy soils, or on muck soils. Preferably, the surface soil should be deep, so that the roots will have a good opportunity to develop. The soil should also be well drained. A soil that is too wet for other vegetables or for grain crops will not produce good chicory roots.

The preliminary preparation and fertilization of the soil for chicory is the same as for the root crops.

**29. Production of Roots.**—The first step in chicory production for the gardener who intends to produce Witloof chicory or Barbe de Capucin, is to grow the chicory

roots for forcing. This work is very similar to the production of carrots, parsnips, and similar roots.

The seed should be sown in drills in the field about June 1. The rows should be spaced from 12 to 18 inches apart, according to the strength of the soil and the method of cultivation

followed. After the seedlings have grown to the height shown in Fig. 8, or possibly a little larger, they should be thinned to stand about 4 inches apart in the row.

The cultivation is about the same as for other root crops, and when given good care in well-enriched soil, the roots should be as large as parsnips. They are then usually plowed out or dug by hand, commonly in October, trimmed of all unnecessary roots and all the top except about 1 inch, and stored until time for forcing during the winter. Sometimes the roots are left in the ground and forced there.

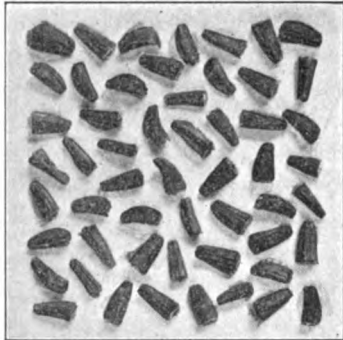


FIG. 7

**30. Production of Witloof Chicory.**—The small, blanched heads called Witloof chicory can be readily produced from good roots during the winter in any vegetable pit or forcing cellar, or in the spaces under greenhouse benches. Perhaps the most convenient place is in a vegetable pit with an earth



FIG. 8

floor. Trenches are dug from 18 to 20 inches deep, or deep enough so that when the roots are stood upright the crowns will be about 9 inches below the surface of the soil, and from 1 to 2 inches apart. Some growers shorten the roots,

sometimes to 5 inches, before setting them in the trenches, but this is not necessary, and it is perhaps an advantage to sink the lower end of the root in the soil at the bottom of the trench rather than to cut it off. As soon as the roots are placed in the trenches, the spaces between and above them are filled with light soil up to the level of the ground.

To stimulate a quicker growth of the shoots from the crown of the root, some growers imbed the roots in spent tan bark and cover them with manure. In this way the time for the production of blanched heads may be reduced by about one-half.

Witloof chicory may also be produced in the field late in the summer and early in the fall by banking the tops with earth,

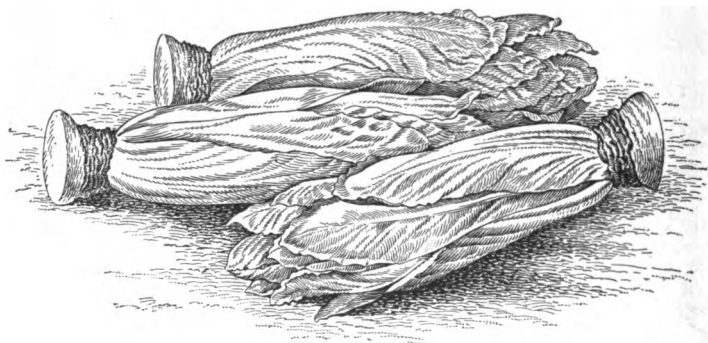


FIG. 9

as for the blanching of celery. The growth of the blanched tops under such conditions, however, is not as rapid as in trenches in a vegetable pit.

When covered with soil in a trench indoors, each root should produce a head similar to those shown in Fig. 9, in about 4 weeks. When the roots are imbedded in tan bark and covered with manure, the time may be reduced to about 2 weeks. These heads shown in the illustration are fairly solid and somewhat resemble cos lettuce.

In harvesting Witloof chicory for market, the head is severed from the root with a sharp knife slightly below the crown. This piece of the root serves to hold the leaves of the head

together and thus makes the product appear to best advantage in the market.

The blanched solid head called Witloof chicory is largely eaten in America as a winter salad like romaine, or cos lettuce. The French sometimes boil it.

There is only a limited market for Witloof chicory, partly because the vegetable is not well known and partly because it is comparatively high priced, selling at from 25 to 30 cents a pound at retail. It is, however, a splendid vegetable, and where a demand exists for it can be produced at a good profit.

**31. Production of Barbe de Capucin.**—The form of chicory leaves known as Barbe de Capucin consists of small blanched leaves which sprout from the crown of the plant in a tuft when the roots are planted with the crowns somewhat exposed in a dark room. It is very similar to Witloof, except that as the leaves are not held compactly together in the soil, they grow rather loosely.

Barbe de Capucin can be most conveniently produced only in a vegetable cellar or in a forcing pit. Mounds of light, moist soil are prepared with one surface sloping back from the bottom at an angle of 30 or 35 degrees. The chicory roots are imbedded in the mound in tiers, so that the crown of each root protrudes about 1 inch from the soil, and so that each tier of roots extends out a little less than the one immediately below it. Darkness in the room is essential so that the leaves will grow blanched, and preferably the air should be warm and moist.

Under good conditions, fine, white leaves should be produced in about 3 or 4 weeks. These are cut when about 6 inches long. They are eaten as a salad, are chopped up and eaten like a slaw, or are boiled and served as greens.

If the roots are allowed to remain in the mounds of earth undisturbed they will continue to produce good leaves for some time, and several cuttings may often be made.

If chicory roots are allowed to stand in the field and are covered with lumber or some other material that will exclude the light, the leaves may be blanched and a product somewhat

resembling Barbe de Capucin produced. This, however, is not of such fine quality as that produced as previously described.

**32. Insect Pests and Injuries.**—No troublesome insect pests nor fungous diseases of chicory are known.

### CORN SALAD

**33. Corn Salad, *lamb's lettuce*, *fetticus*, or *vetticost*,** is a native of Europe, where it is highly prized; it is little grown in America. The most common type of the plant has long, narrow leaves, which are pale green in color and are covered with a bluish-white bloom. There is also a kind with round leaves, which are thicker than the others and dark green. The plant frequently grows to a height of 2 feet, but in spite of this the leaves are usually tender. Only the variety with the long, thin leaves is known in America, although several varieties are

known in Europe. A full grown corn-salad plant is shown in Fig. 10.



FIG. 10

Corn salad is chiefly used as a salad, and as a substitute for lettuce. It is rather tasteless, however, and hence not so well liked as lettuce; only persons who like a very mild salad care

for this vegetable. It is sometimes served in mixtures with other salads, like lettuce, watercress, etc. In some cases it is used as a green, or pot herb, like spinach.

If allowed to grow until the hot weather, the plant throws up pale-blue flowers and readily produces seed. The seed may be shaken out of the flower head very easily when mature, and a convenient method of harvesting is to spread a cloth under a plant and jar it until all the seed have fallen out.

**34.** Corn-salad seed is of fair size; about 15,200 weigh 1 ounce; 1 quart of the seed weighs a little less than 11 ounces.

A sample of corn-salad seed is shown natural size in Fig. 11. Seedlings of the plant in an early stage of growth are shown natural size in Fig. 12. The seed has been kept in a satisfactory condition for 6 years, although this is not desirable. About 2 ounces of the seed will be required to sow about 100 feet of drill, and when the seedlings are grown for transplanting, 1 ounce of seed will usually give from 2,000 to 3,000 plants.

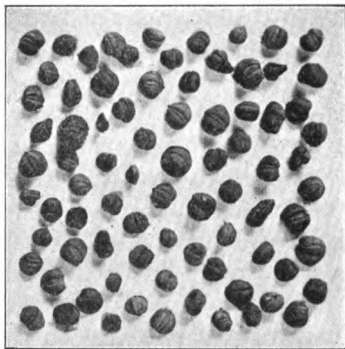


FIG. 11

**35.** In the North, the common time for sowing corn-salad seed is early in the spring, at about the same time that the first sowing of lettuce is made, and successive plantings are made as long as the salad is desired. The plant will come to maturity in from 60 to 65 days in favorable spring weather, and none should be planted so late that it will not reach marketable size before the hot weather of the summer. In hot weather or in dry places, the plant readily runs to seed. For the production of very early salad plants, the seed is sometimes



FIG. 12

sown in September and the plants wintered over like spinach under a light mulch of straw. In the South the seed is commonly sown in successive plantings from August until frost.

**36.** The rows for corn salad need not be more than 12 inches apart, although, to facilitate tillage, some growers prefer

to space them about 18 inches apart. The seed should be covered with only a very little soil. As soon as the seedlings have reached a fair size they should be thinned to stand about 6 inches apart in the row. The young seedlings that are thinned out may be used as food.

**37.** Cultivation should commence as soon as the seedlings are up and some hand hoeing will be necessary to keep the rows free from weeds. When possible, an abundance of water should be given. The leaves may be blanched by tying them up over the center, but usually they are eaten green. It is rather easy to produce a satisfactory crop of this vegetable in a cool soil.

**38.** There are no serious insect pests or diseases that attack corn salad.

**39.** The sale for corn salad is rather limited, and its chief place of usefulness is in the home garden.

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## CRESS

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### WATERCRESS

**40.** Watercress is the most important, commercially, of the three different kinds of cress, namely, watercress, garden cress, and upland cress. These three forms of cress belong to the mustard family. Watercress is a hardy, perennial, aquatic plant that has small, roundish leaves; the main stems are more or less prostrate, but the young, succulent stems are nearly upright when the plants grow together thickly. It is grown under glass to some extent during winter. It is a popular market crop at certain seasons, especially in the city markets.

Watercress is popular as a condiment because of its warm, pungent taste. It is used alone and in mixed salads, and is also extensively used as a garnish with meats.

41. Seedsmen usually list only one kind of watercress, and any of the smaller differences that may exist between different strains receive little attention.

42. The seed of watercress is exceedingly small; about 113,500 weigh 1 ounce; 1 quart of watercress seed weighs about 20 ounces. Cress seed is of average longevity, the average length of time during which the germination will be satisfactory being about 3 years; the extreme limit is 5 years. Watercress seed germinates in from 7 to 12 days. To be considered of high grade, cress seed of any kind should be about 99 per cent. pure, and about 90 per cent. of the seeds should germinate.

43. Propagation of watercress plants is usually better by means of cuttings, but reliable seed can be purchased from a large number of seedsmen. Seed are usually planted under glass for the production of early plants for setting. In pound lots, high-grade watercress seed usually retails at about \$4 a pound.

44. As watercress is an aquatic plant, it thrives best where there is an abundance of moisture. The most natural conditions, and the most favorable for commercial production, may be found in shallow, running water; the water must be pure and clean or the cress will not be safe to eat. The water should be not less than  $1\frac{1}{2}$  inches deep nor more than 2 or 3 inches deep. To insure the cleanliness of the cress, the bottom of the stream should be of sand or gravel. Pools formed by springs, in which the water is continually in motion, are also suitable for watercress, provided they are not too deep.

Watercress does not have to be grown entirely in water, as in a stream, although the chances for commercial success are better under such conditions. The plants will do well in many wet, or moist pieces of ground that are well shaded from the sun. Many upland soils may be made to produce good crops of watercress if an overhead system of irrigation is provided. Harvesting on such a patch would be much easier than in water. Watercress can also be grown to advantage in a greenhouse, where the conditions of moisture and temperature can be closely controlled.

**45. Planting.**—Watercress plants can be readily started by scattering the seed along the edges of brooks or around springs, or by dropping some freshly-cut short pieces of stems in the water. These will quickly send out roots and thrive. In soil, the quickest way to produce watercress is to plant short pieces of freshly-cut stems; the soil should be a wet one.

When watercress is planted in a wet soil or in a field where an overhead system of irrigation is installed, the stem cuttings should be set about 6 to 8 inches apart each way. If small plants are to be set in the water, they should be arranged in rows, parallel with the current of the stream and about



FIG. 13

18 inches apart and the roots fastened on the bed of the stream with a small stone. Small plants for setting may be readily secured by starting them under glass early in the spring, and then transplanting them into flats, in which they are spaced about  $1\frac{1}{2}$  inches apart each way. When raised in this way, the plants must be watered frequently.

As watercress is a hardy perennial, it will flourish and rapidly extend when once it has been established under favorable conditions, especially if it is grown in shallow water. A thick mat of watercress plants growing in a shallow stream is shown in Fig. 13. If, however, the stems of the plants get choked up

with mud or weeds, they must be taken up, the beds cleaned up, and the plants reset.

**46. Diseases.**—Only two or three fungous diseases that attack watercress are difficult to control. These, however, rarely appear when the conditions under which the plant are grown are suitable to the crop. Commercial growers never attempt to control these diseases by spraying, but depend on the selection of a proper location to avoid loss from them.

**47. Harvesting and Marketing.**—In harvesting watercress, the stems should always be cut and not broken off, as



FIG. 14

the breaking always injures the plant. The stems are commonly cut in lengths of about 6 inches and are tied into small bunches of from  $1\frac{1}{2}$  to 2 inches in diameter, as shown in Fig. 14.

In the markets, watercress is commonly sold by the dozen bunches, or sometimes by the hundred bunches. By the dozen bunches, the price ranges from about 15 cents to as high as \$2.50, the latter price, however, being received only during times of great scarcity during the winter.

## GARDEN CRESS

48. **Garden cress**, *pepper cress*, or *pepper grass*, is one of the popular salad plants of Europe; it is grown only to a limited extent in the United States, in spite of the fact that its quality seems to warrant a place for it in almost every garden. Garden cress is a spring and fall crop, and does not do well in midsummer; in midsummer and late in the season it runs quickly to seed. It may be cultivated indoors during the winter, wherever enough light and moisture can be supplied. Garden cress is a short-season annual, and is considered by many to be one of the best of the early salad plants.

This plant can be grown in almost any garden soil that is in good tilth, but an abundance of moisture and quickly-available



FIG. 15

plant-food must be present if a rapid growth of desirable crisp and tender leaves is to be secured.

49. In seed catalogs, garden cress is commonly listed as curled cress or pepper grass. This kind has finely curled, ornamental leaves, and is much to be preferred to the coarse and inferior broad-leaved kinds.

The common garden-cress seed is larger than watercress seed, about 13,000 weighing 1 ounce; 1 quart of seed weighs about 28 ounces. In pound lots, the seed commonly retails at about 70 cents a pound. Seedlings of the curled garden cress are shown in Fig. 15.

**50.** Garden cress is usually sown thickly in shallow drills about 12 inches apart, and should be cultivated often enough to keep down all weeds and to maintain a good dust mulch. Irrigation is particularly beneficial on this crop; in fact, artificial watering is almost a necessity.

Under favorable conditions, the leaves will be large enough for harvesting about 4 to 6 weeks after the seed is sown. Some persons prefer the leaves when they are about 1 inch high, but the leaves are usually allowed to grow to a height of 2 or 3 inches before they are cut. The leaves may be cut as wanted, and the plant will continue to throw up others. Usually, however, a continuous supply is provided by sowing seed every week or two.

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#### UPLAND CRESS

**51.** The **upland**, or **American**, **cress** is the least important of the three forms of cress. It is found in its native state over a considerable part of the United States, but, although it is such a common plant, it is seldom cultivated.

Upland cress is usually a biennial; the young seedlings spring up from seeds that are dropped from the plants in the summer, and then themselves send up flower stalks the following spring and produce seed during their second summer. It is, however, grown as an annual. The plant is hardy to cold, and does not run to seed as rapidly as the garden cress does in warm weather, but the crop in the summer should be grown in a shady location, because the leaves produced in the hot sunshine are tough and bitter. Upland cress is very similar both in appearance and in flavor to the more commonly cultivated watercress, and many persons do not readily distinguish between the two in the market. The leaves lie nearly flat on the ground and are often soiled by rains.

Upland cress is used as a condiment, is served with salads, and is used for garnishing. It should be found more commonly in the home garden. More or less of a market may be found for it in localities where its somewhat more desirable relative, watercress, is in short supply.

**52.** There are no distinct varieties of upland cress, and it is usually listed in seed catalogs simply as upland cress or as American cress. The seed is somewhat smaller than the seed of garden cress, about 17,000 weighing 1 ounce; 1 quart of upland cress seed weighs about 20 ounces.

**53.** The crop may be raised in two ways: (1) By sowing the seed late in the season, in which case the plants will be ready for use early the following spring, the hardy nature of the plant enabling it to live through the winter without injury; and (2) by sowing the seed as soon as possible in the spring, in which case the plants will be ready before hot weather sets in. Upland cress requires a somewhat longer time to reach a marketable stage than garden cress—usually from 7 to 8 weeks. The culture is the same as for garden cress.

**54.** The leaves are cut and tied in bunches of a diameter of about 2 inches. The cress is sold by the dozen bunches, and the price ranges from 10 cents a dozen bunches up; it does not ordinarily bring as much as watercress.

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## PARSLEY

**55.** Parsley, the most popular of the garnishing vegetables, is a native of the southern part of Europe. The crop is rather extensively grown in the United States, although its commercial importance is not as great as that of the important salad crop. There is a limited demand for it throughout the year, and the crop is found regularly on most market gardens and in many greenhouses. Probably the bulk of the parsley used goes to hotels, restaurants, and to grocers and retail butchers who use it in decorating their stores or include a few sprigs of it with orders of meat for their best patrons. Parsley is rarely included among the vegetables in the home garden, although a half dozen plants or so would yield a plentiful supply for a family throughout a whole season, and would require next to no attention after the plants are well established.

**56.** Parsley is a close relative of the carrot and celery. Its manner of growth is very similar and it thrives under similar

soil and cultural conditions. The seeds are inclined to be weak and slow to germinate. The plant is very hardy, may be planted early in the spring, and will stand wintering over in most localities without injury. The plant is a biennial, but is grown as an annual, except when seed production is the object.

Parsley is used more extensively for garnishing than any other salad crop. It is also used in seasoning soups, stews, and meats. The green leaves are sometimes eaten raw after eating onions, leeks, etc., in order to diminish the unpleasant taste in the mouth and odor of the breath. Parsley may be dried, powdered, and stored in bottles, but in most climates, where the vegetable can be had green the year round, there is no object in doing this.

**57.** As compared with lettuce and celery, parsley is a small crop commercially, but it is more than one-half as valuable a crop as all the other salad crops combined, with the exception of lettuce and celery. In 1909, the crop was reported as being raised commercially in eleven states. The bulk of the crop was raised in Louisiana, New York, Virginia, Pennsylvania, Massachusetts, and New Jersey; Louisiana alone raised nearly half of the entire crop. Florida, Illinois, California, Maryland, and South Carolina also produced the crop commercially, but not in as large quantities as the states first mentioned. The total value of the crop was placed by the census at \$27,181, raised on 192 acres, distributed among 112 farms. The average income per acre was more than \$140. The commercial crop is considered to be that which is raised in patches of 1 acre or more. In the case of parsley particularly, however, immense quantities are raised in patches smaller than 1 acre.

**58. Soil.**—The soil for parsley should be a well-drained, rich, medium or light loamy soil, so that it can be prepared early in the spring. Almost any garden soil will produce fair crops, but if the crop is attempted on a large scale, special care should be taken to see that the soil is in a high state of fertility.

**59. Varieties.**—Several types of parsley are grown for market, including those with curled leaves, those with plain

leaves, and those with a root somewhat like a turnip. The principal varietal differences between the curl-leaved varieties occur in the form of the leaves, and those with the curled leaves are the most popular in American markets.

**60.** The **Extra Curled Dwarf**, or *Emerald*, parsley, a bunch of which is shown in Fig. 16, is fairly representative of

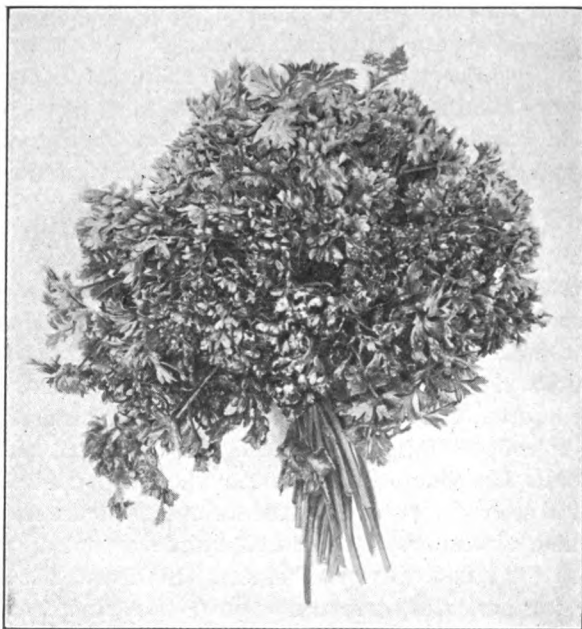


FIG. 16

the varieties with curled leaves. The leaves of this variety are mosslike, finely curled, and of an attractive, bright-green color.

**61.** Other varieties of the curled group are the **Moss Curled** and the **Double Moss Curled**. These are like the first variety named, except in the color of the leaves, which are dark green. Many other variety names are used to indicate different strains of these three varieties, but there is little essential difference between the different kinds.

**62.** The **Plain**, or *Single*, parsley, is a favorite in Europe and there is a certain demand for it in this country by foreign-born persons. The leaves are comparatively plain, have a little curl, the foliage is less dense than the foliage of the curled varieties and of a lighter green, and the leaves and stalks are small. This variety is not extensively raised.

**63.** The **Turnip-Rooted**, or *Hamburg*, parsley is representative of the turnip-rooted varieties, and is little grown in America. The edible part of the plant is the fleshy root. This somewhat resembles a small-sized parsnip, and is used chiefly in flavoring stews and soups.

**64. Seed and Seed Production.**—Parsley seed may be easily grown in all parts of the country. The selection of the plants should be carefully made, especially in the case of the curled varieties, because deterioration is certain to follow if plants for seed production are selected indiscriminately.

Two methods of handling the plants for seed production may be followed. The roots may simply be allowed to remain in the ground over the winter, a mulch being placed over them for a certain degree of protection, or the roots may be taken up in the fall, stored over winter, and replanted in the ground the first thing in the spring. The first method has the advantage of requiring very little labor; the undesirable plants are merely pulled out and thrown away, and the desirable ones are allowed to remain where they stand. It is, however, wasteful of space, because of the blanks left in the rows by the thinning-out process. The mulch, which is usually of straw, is placed over the rows after the ground has frozen to a depth of several inches.

When the roots are stored over winter they are reset in the spring to stand about 18 inches apart each way. This latter method is generally considered to be somewhat the more preferable.

The seed stalks should be cut when most of the seed are ripe. They should then be dried on sheets to prevent the loss of the seed, and the seed thrashed out, or, if the quantity is small, they may be stripped off by hand. Most commercial

growers run the seed through a winnowing machine to remove the chaff and light-weight seed.

**65.** Parsley seed is of medium size, about 15,000 to 16,000 weighing 1 ounce; 1 quart of seed weighs about 24 ounces. A

sample of Extra Curled Dwarf parsley seed is shown natural size in Fig. 17.



FIG. 17

Parsley seed is of medium longevity, the average period of satisfactory germination being about 2 years, and the extreme limit about 5 years; but commercial growers prefer to use seed about 1 year old. Parsley seed is very slow to germinate, from 12 to 20 days being required for this process, and very

frequently the full 20 days will be required. A few parsley seedlings are shown natural size in Fig. 18. To be considered high grade, parsley seed must be about 99 per cent. pure and about 80 per cent. of the seed should germinate. Many samples of parsley seed will not, however, show as good a germination

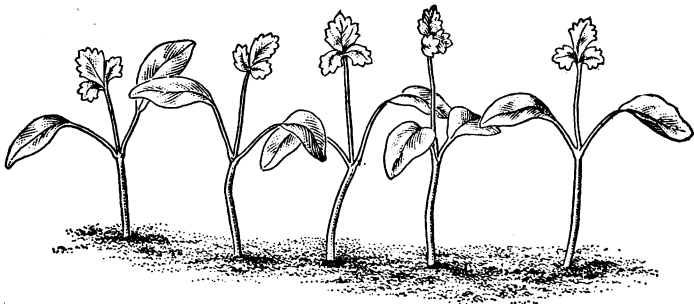


FIG. 18

test as this. When planted late in the season, parsley seed is often soaked for about 12 hours in warm water before it is placed in the ground, in order to facilitate germination. This can be most conveniently done by tying up the seed in a

cheese-cloth bag so it will be kept in a small compass while in the water. While wet the seed will stick together and will be difficult to sow, but this difficulty can be readily overcome by mixing the seed with some fine, dry dust as soon as the water is poured off of them; this will take up all the excessive moisture and make the seed easily separable.

**66.** At the common distances of planting in drills, about 2 to 3 pounds of parsley seed will be required to sow 1 acre, and from  $\frac{1}{4}$  to 1 ounce will serve to sow about 100 feet of drill. In pound lots, parsley seed retails for about \$1.25 to \$1.50 a pound.

**67. Field Culture.**—The area that should be planted to parsley is the first matter that should receive attention in the culture of this crop by a market gardener. Usually the area devoted to this crop should not be large, because the demand is rather limited. In a large market, a steady trade for a few bushels a day may be obtained, but, in a small town, from 1 to 5 bushels a week would probably supply the greater part of one gardener's customers, and might possibly supply the demand in the entire town.

**68.** The soil for parsley should be heavily manured, deeply plowed, well harrowed, and the surface soil thoroughly fined with a Meeker or other smoothing harrow or a hand rake. The time for planting will be immediately after this work can be completed, even though, in the North, this be the last of March or the early part of April. The plant is perfectly hardy and the long time required for the germination of the seed makes early planting almost essential.

Because of the slowness with which parsley seed germinates, some other seed that germinates more quickly is usually sown with it, in order to mark the rows and make early cultivation possible. A cheap grade of lettuce, radish, or turnip seed is suitable for this purpose; if radish seed is sown thinly, the radishes may be allowed to mature in the parsley rows without interfering with the parsley. To assist in the germination of parsley seed that is planted rather late in the season, the seed is soaked in warm water and dried as previously described.

**69.** The rows, or drills, for parsley should be spaced about 12 inches apart, and the seed should be sown rather thickly; as many as 1 or 2 dozen seed to the inch will not be too many unless the seed is fully up to a high-grade germination of 80 per cent. Most markets prefer a small, fine-leaved parsley, which can be most easily produced by a thick stand of plants in the row.

The parsley seedlings will not appear above ground in much less than 2 or 3 weeks, and the plants will grow very slowly for the first 4 or 5 weeks after they appear. After the plants have developed a good root system, however, the growth will become very vigorous, and will normally continue so throughout the life of the plant.

**70.** Cultivation should be the same as for any of the closely planted vegetables. The parsley seedlings should be kept free from weeds, and if any other vegetable seeds were planted with them, these seedlings should be taken out before they interfere with the growth of the weaker parsley seedlings.

If at any time the growth of the parsley plants seems to be at a standstill, a light sprinkling of nitrate of soda will usually be sufficient to start the plants off into a vigorous growth again. The maintenance of a good soil mulch by cultivation will do much to keep the plants growing steadily.

**71. Production of an Early Crop.**—The production of an early crop of parsley is desirable, because a crop that can be gotten into the market somewhat earlier than the bulk of the regular crop will always bring high prices. As parsley is sufficiently hardy to winter over, even in the northern parts of the United States, without injury, if it is protected by a light mulch of straw, an early crop is sometimes produced from old roots from which a crop has been harvested and wintered over in this way. These plants will give a fair yield of marketable foliage early in the spring, but as the plant is a biennial and soon runs to seed the second year, only the very first growth can be used, because the foliage soon becomes unfit for market. The expense of producing an early crop in this way is smaller than for producing it under glass, because there

are no items of extra expense to charge up to the crop except the cost of the light mulch and the cost of removing the mulch in the spring. Because of its cheapness, this method of producing an early crop of parsley recommends itself to many growers.

**72.** A more recent method of producing an early crop of parsley is to sow the seed in hotbeds or cold frames and then transplant the seedlings into the field; sometimes the plants are grown to a marketable size directly in the frames.

In the latitude of New York city, parsley may be sown under glass at any time from February 15 to March 15, and will pay well, especially if it is grown in combination with some other readily salable crop; very frequently, parsley is sown in frames between rows of lettuce at a time when the lettuce is far enough developed that it will be ready for harvesting in about 4 weeks; the lettuce will then be off the ground and out of the way before the parsley will need much of the space.

**73.** If parsley is started in frames as early as February, the plants should be spaced far enough apart so that they can grow to marketable size in the frame. Parsley may sometimes, however, be planted in frames as late as April 15, the plants transplanted to the field, and made to give a marketable crop from 1 to 2 months before the field-sown crop is ready for market. If started much later than February, the seedlings may be transplanted to the field. When this is to be done, the seed is sown much more thickly than when the plants are to be allowed to develop to their full size in the frame.

The work of transplanting is performed very similarly to that of transplanting celery or beet seedlings. It involves considerable labor, and, to result in profit to the grower, must be done with much care.

**74. Winter Production.**—As a winter crop of parsley is usually profitable, many gardeners now devote a part of their frames to this crop. This crop is an economical one to produce during the winter, because cold frames can be used in most localities, and if the climate is not too severe the parsley

can be made to yield a moderate harvest during the entire winter, and with considerable profit per sash.

For a winter crop, parsley seed should be sown about July 1, so that the plants may become well developed by about September 1. Two methods of handling the crop may be followed: The roots may be lifted and transplanted in the frames, or, better still, the seeding may be so planned that a temporary frame can be built about the parsley bed and sash put over it when the weather becomes cold enough to make this necessary.

When the cold weather of the winter sets in in earnest, the sides and ends of the frames should be banked with manure, and the sash managed in such a way that the temperature in the frames will always be low enough to keep the parsley growing slowly.

The harvesting is the same as for the crop in the field, and the demand is usually very active for parsley in the winter.

**75. Insect Pests and Injuries.**—The insect pests that attack parsley are few in number. The most damaging is the **parsley worm**, or *celery worm*, which has been described in connection with carrots. Hand picking has been found to be the only effective method of control. Sometimes **wire worms** feed on the roots of parsley, but they seldom do serious damage.

Fungous diseases rarely do damage to parsley. The foliage will sometimes rust or blight to a slight degree when immediately adjacent to a field of badly infected celery, but this will seldom be serious enough to make the leaves unmarketable.

**76. Harvesting.**—In about three months from the time of the sowing of the seed, parsley should be big enough to cut, that is, the foliage should be from 4 to 6 inches long and each plant should contain a good handful of marketable parsley. In harvesting, all the large leaves of the plant are grasped in the left hand and the stems cut at about 1 inch from the crown with a sharp butcher's knife; under no conditions should the cut be made so low that the heart leaves will be injured or the future growth of the plant will be seriously retarded. To cut practically all the foliage from a plant in this way may seem to be harsh treatment, but a well-established plant apparently

suffers little injury from it, and the speed with which the crop can be cut by this method is a decided advantage.

Immediately after the large leaves are harvested, the plant should at once start to throw up a new crop of leaves, which in turn are cut off when they have become large enough to market. This procedure can be repeated several times, or until the cold weather checks the leaf growth of the plant. If at any time during this process of cutting back the foliage, the parsley plants appear to lack food, an application of a high-grade fertilizer, of which nitrate of soda makes up the greater part, well cultivated in, will usually be sufficient to start the plants into a vigorous new growth.

The best method of harvesting parsley, and usually the only way in which much profit can be secured from the crop, is to harvest only as much each day as the market will take, cutting from one end of the patch straight along the rows to the other. The grower who has been able to estimate his market demand with fair accuracy will thus find the plants that were cut first ready for another harvesting as soon as the last plants on the patch have been cut.

**77. Marketing.**—Some markets will take parsley only when it is bunched, and others will take it loose in bulk. For bunching, parsley must have longer stems and a larger growth than when it is to be sold loose. The bunches, however, vary in size in different markets. A bunch of parsley of average size is shown in Fig. 16. Parsley is improved for market by washing; this not only cleans the leaves, but the wetting makes the foliage more crisp.

When parsley is sold bunched, the unit is either a dozen or a hundred bunches. In markets that will take parsley loose, the vegetable is usually sold by weight or measure. When parsley is scarce, from 7 to 9 pounds is commonly put in a bushel box or basket, but when the market is glutted, the boxes are often crowded full and weigh much heavier.

**78.** The prices received for parsley are very variable. When there is an abundant supply in the market the prices are much depressed, but as restaurants and hotels count it

among their necessities, as soon as a shortage occurs the price goes up rapidly. Bright, clean-looking parsley always sells for better prices than dirty or brown-edged parsley.

In the New York wholesale markets, parsley is sold most commonly by the hundred bunches, but is also sold by the box, case, barrel, and crate. All of these different designations are rather indefinite, even that of the hundred bunches, because parsley is compressible, and one packer may put a great deal more in a bunch or a package than another.

During the 10 years from 1903 to 1912, inclusive, the prices for parsley have varied about as much as for any vegetable. The quotations have varied from 75 cents to about \$7 a hundred bunches, from 75 cents to \$2.50 a box, from \$2 to \$3.50 a case, from \$1 to \$9 a barrel, and from 30 cents to 75 cents a crate. These, of course, are the extreme variations in price, but during the best part of the season large quantities of parsley are moved at from \$2 to \$3 a hundred bunches. In some of the smaller local markets, the price may vary from as low as 10 cents to as high as \$4 or \$5 a bushel.

**79.** Prior to about 1910, parsley was found regularly in the markets only from about December to the latter part of June, but in recent years small quantities have also been quoted in August, September, October, and November. During the 10 years in question no parsley had been quoted in the New York markets during July. The best prices for the vegetable are commonly obtained from December to May or June, although the prices will occasionally drop to about \$1 a hundred bunches and lower even during that time. The top-notch prices have usually been secured during February, March, and sometimes in April.

**80.** For a whole season's cutting, the yield from 1 acre of parsley should amount to from 250 to 500 bushels or more; this, of course, will include the product from several cuttings.

The cost of production is small, as likewise is the cost of harvesting and of preparing the crop for market when it is sold loose in bulk. The labor of bunching parsley adds considerably to the cost of production.

# GARDEN BEANS

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## GENERAL DISCUSSION

1. Beans in general may be classified according to their methods of culture, and without regard to botanical classification, into field beans and garden beans. **Field beans**, sometimes called dry beans because they are dried before being marketed, are grown much in the same way that a grain crop is grown. The seeds, or beans, of the plant are the only marketable part. **Garden beans** from a cultural point of view, are an entirely different proposition. They must have care and fertilization that could never pay on a crop of field beans, and although the risk is higher the possible profits from a given acreage are also greater. The beans are marketed green in the pod for immediate consumption, some being eaten pod and all and others being shelled before being eaten. They are a very important vegetable crop, ranking among the first ten in value and are near the head of the list in acreage and are one of the two pulse crops of importance to the commercial vegetable grower, the other being garden peas.

2. Many classifications of beans have been made. Classifications made on a botanical basis, are not always clear to the practical man. For this reason, the classification of field and garden beans made by L. C. Corbett, of the United States Department of Agriculture, which is satisfactory for practical purposes, is given in Fig. 1.

3. In this Section, as only garden beans are considered, these may be grouped as kidney beans and lima beans; the bush

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and pole beans of each type and their subdivisions are described. Among the kidney beans are found the dry beans—with the exception of the limas—the snap beans, and the green shell beans. The lima bean is always a shell bean, the garden crop being a green shell bean; dried lima beans are not considered as being

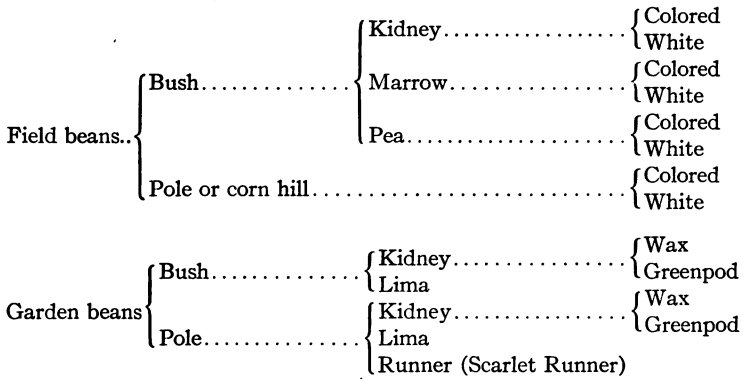


FIG. 1

a garden crop. For convenience, garden beans will be considered as being classified as shown in Fig. 2.

4. In speaking of garden beans the terms snap pods and shell pods are often used. **Snap pods** are pods at the stage when they may be eaten. **Shell pods** are pods at the stage

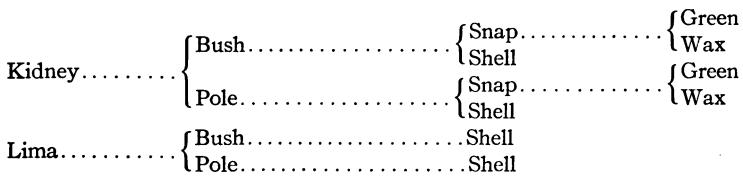


FIG. 2

when the beans in them are more or less mature; such pods are not eaten, but the beans are shelled out and eaten; shell pods are sometimes green in color, but more often they are yellow or yellow splashed or striped with red, and have a mature appearance. The term green (fresh as contrasted with dried)

shell bean is applied to shell beans that are sold when only partly matured, such as fresh lima beans. The term green used in this sense should not be confused with the term green as applied to color.

5. Beans are a tender crop, subject to complete destruction when exposed to a hard frost. Even when exposed to a light frost, they are usually so severely injured as to render their subsequent growth unprofitable.

6. Snap and shell beans are not usually grown on high-priced land, such as that worked by many of the intensive market gardeners near the large cities, because these crops do not return as much net profit per acre as many other vegetable crops that can be grown.

7. Snap, or string, beans are now found in the larger northern markets at all times of the year, the growers from Maine to Florida supplying the market at different times. The northern vegetable growers usually limit their production to enough to supply local markets. At certain seasons, however, the Maryland, Carolina, and Florida truckers ship large quantities to the northern markets and keep these markets supplied with snap beans when the northern growers, because of climatic conditions, cannot do so.

8. **Composition and Nutritive Value.**—Beans have a high nutritive value and are generally very desirable as articles of food. They contain the most nutriment when mature and dried, but even when in the snap- and shell-bean stage, they are, as regards composition, equal or superior in nutritive value to other green vegetables. The ripened beans are high in protein, and are of a much higher nutritive value than most other vegetables. Fresh shelled beans contain a fairly large quantity of protein, or nitrogenous material, which serves to build up and repair body tissue as well as to furnish energy for the body; fresh shelled beans also contain considerable carbohydrates and a small quantity of fat, both of which nutrients serve to supply the body with energy. Canned beans resemble in composition the same materials uncooked. Ripened beans contain more

protein than the grains commonly used as food, such as wheat, and compare favorably in protein content with the animal foods.

**9. Commercial Importance.**—The green, or garden, bean is grown extensively throughout the United States, and to a greater or less extent is produced commercially in every state in the Union. According to the census of 1910, the states of most importance in the production of green beans, ranking in the order of the value of the crop produced within their limits were: Florida, California, New York, New Jersey, Virginia, Maryland, South Carolina, Georgia, Texas, Kentucky, and Massachusetts. The first ten of these states produce more than 70 per cent. of all the green beans grown in the country, and Florida alone produced more than 16 per cent. of the total.

The total value of the green bean crop in the United States in 1909 was \$2,844,951; this crop was raised on 53,610 acres distributed among 21,561 farms. These figures include only the crop that was grown in areas of 1 acre or more, and does not include the large quantities grown in smaller areas and in home gardens. The average income from green beans in the whole country was about \$55, the average income per farm about \$130, and the average acreage per farm about 2.48 acres. In Florida, the average income per acre was about \$96. Progressive growers have little difficulty in securing much larger incomes per acre.

**10. Income and Cost of Production.**—The yields of string beans are variable, from 100 to 250 bushels to the acre, and it is not unusual for some growers to average 200 bushels per acre consistently. The yield will vary with the variety, soil, season, and management. With a yield of 200 bushels and prices averaging from 50 cents to \$2.50 a bushel an income of \$100 to \$500 per acre may be secured by a progressive grower, although the latter income would be considered very exceptional.

The cost of production per acre of snap beans will vary according to the management and yield from \$35 to \$75 an acre, exclusive of interest on the investment in land and equipment, and management. The cost of production for lima beans will be somewhat higher.

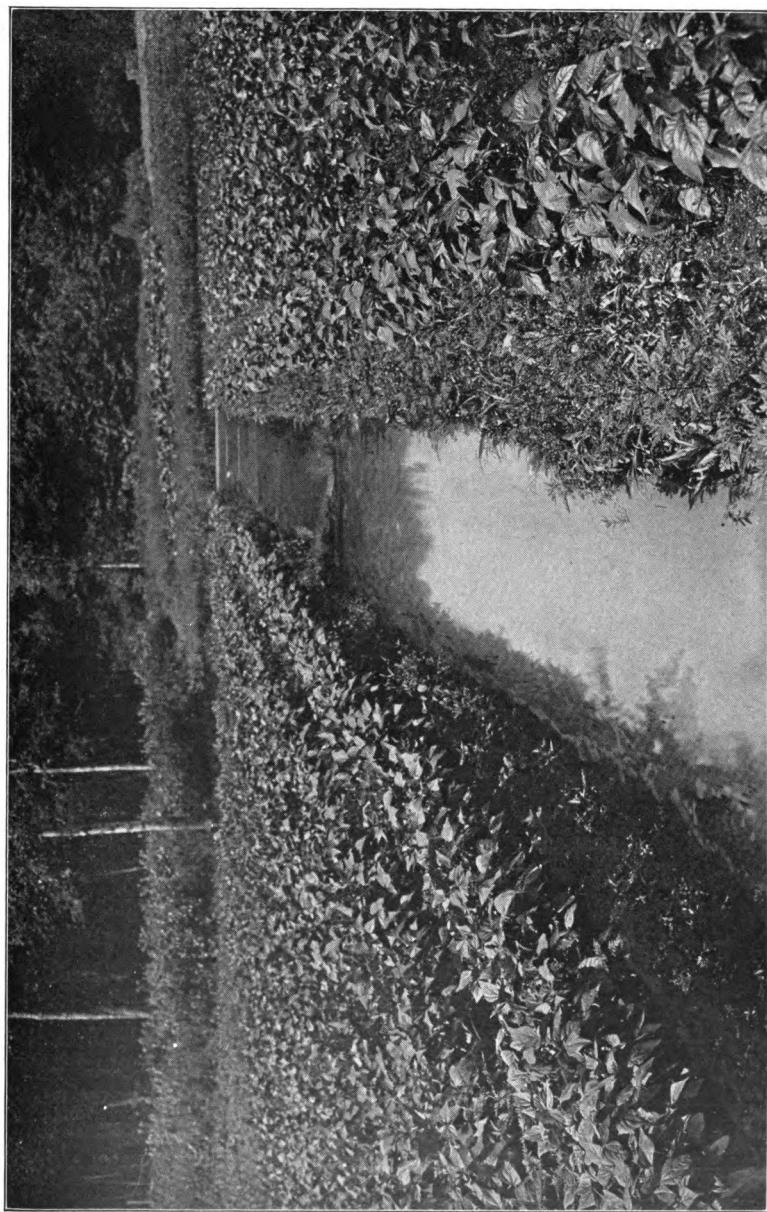


FIG. 3

**11. Soil for Beans.**—To be suitable for beans, a soil must be well drained and contain at least a fair quantity of humus. When these two requirements have been met, almost any type of soil when properly handled will produce satisfactory crops of beans. The soil that is the more nearly ideal for this crop, however, is a medium loam soil. Very light land on the average is not the best for this crop, although some varieties will do well in it; a maximum crop cannot be expected on a heavy soil, but a good crop may be secured if the land is well drained. Muck soil may also be made to produce good crops of beans. In Fig. 3 is shown a fine crop of beans growing on a muck soil. The water-table was less than 24 inches from the surface, and ditches were necessary to keep the land well drained. In spite of this fact, however, this muck soil is so well filled with humus that both air and moisture are present in it in approximately the right proportions to produce a quick-growing and highly profitable crop.

Beans require an abundance of air in the soil, are unfavorably affected by the presence of any free acid in the soil, and respond quickly to the stimulation of an abundance of the plant-food elements. Under normal conditions, a large quantity of humus in the soil will provide the right conditions of aeration and moisture. Plant-food must be applied to the soil in the form of manures and commercial fertilizers. As previously mentioned, a niggardly application of either manure or commercial fertilizer to garden crops is a poor policy. This is particularly true in the case of land intended for beans because an abundance of plant-food stimulates the growth of the nitrogen-gathering bacteria that produce the nodules on the roots that are so essential to the welfare of this crop. Too large a quantity of available nitrogen in the soil is, however, considered to cause the bacteria to grow slowly. In Fig. 4 is shown a pole-bean root with a fine development of nodules attached. This root grew on a piece of heavy soil, rich in plant-food and yet shows an excessive production of the nodules. Though this is somewhat of a contradiction of what has just been said, about an abundance of nitrogen hindering the growth of these organisms, still it serves as an indication of

the practical impossibility of determining definitely the conditions that accelerate such a growth.

12. The point just mentioned illustrates a factor of much importance with reference to bean culture. After many experiments it seems impossible, without an actual trial, to

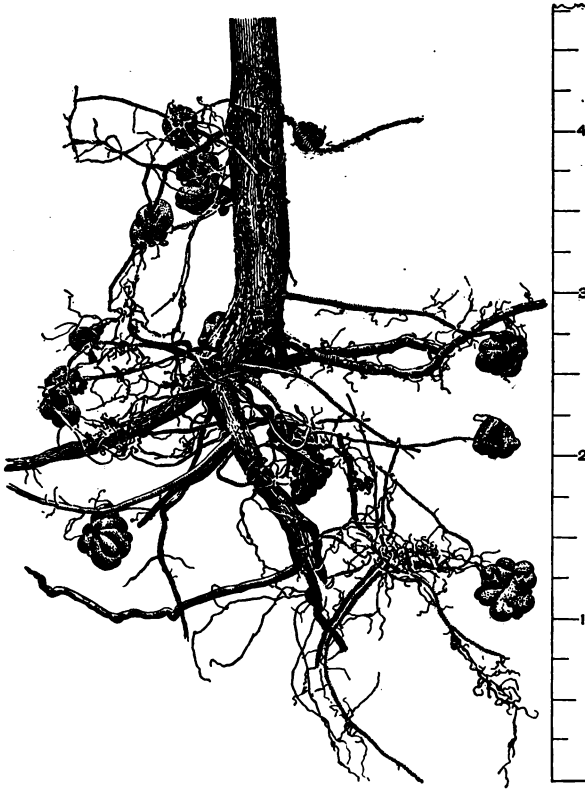


FIG. 4

determine with any accuracy the probable success of a bean crop in different localities and on different soils. Only general statements can be made. On some soils, experiments have shown that the application of potash alone has produced a profitable return, while on other soils of apparently near the same character practically no increase in yield has been

produced by the application of potash. The same is true with reference to experiments with the other fertilizer elements on the bean crop. Different varieties also do better in some localities than in others. All these facts indicate the extreme sensitiveness of the bean plant to minor variations.

Notwithstanding these facts, however, the bean crop may be considered one of the easiest of the garden crops to grow, even though the yields will vary so much in different localities. A fair yield can be obtained in a great many places.

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## KIDNEY BEANS

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### VARIETIES

13. Kidney beans are native to North America and were one of the three crops found by the early settlers to be under cultivation by the Indians, the other two being corn and tobacco. They were introduced into England and into Europe generally, from the United States in the 16th century. There are many varieties of garden kidney beans, and they vary in size, shape, and color. Considerably more than 150 distinct types of garden kidney beans are known in the United States. An examination of the catalogs of American seedsmen has shown that more than 400 varietal names of kidney beans are used; many of these, of course, are duplicates, the same bean going under more than one name. These statistics indicate the variable character of the bean plant. This variability is all the more remarkable because it is due to the inherent qualities of the plant and to the influence of environment, and is not due to sexual crosses as in the case of most plants; the bean blossom is practically always self-fertilized, an uncommon condition among vegetable plants.

14. The kidney beans rank high as a market crop, the greatest demand being for the varieties with a tender, meaty pod, which can be used for food before the bean seed has developed to a size which will permit of shelling. The garden kidney

bean group is referred to by different names; probably, the most common names are snap, or string, beans. Oddly enough, however, the best of the so-called string beans are stringless.

15. The bush varieties of beans are by far the most popular, both in the commercial patch and in the home garden, largely because less labor and expense is required in their production than is required in the production of pole beans. The average bush-bean plant grows about 18 inches in height, has a spread of foliage of about 12 inches, may bear from thirty to one hundred pods to a single plant, and matures, according to variety and season, in from 45 to 60 days. Most of the bush beans are grown for their edible pods, which within a comparatively few years have been greatly improved by seed breeders in size, tenderness, and general quality.

16. Pole beans are the type that have a climbing habit. They will readily twine about any object that will give them support, and hence when they come in contact with a pole they twist about it and grow up toward the top of the pole. The cost of poles and of setting is a strong argument against the growing of pole beans for market as compared with the growing of the dwarf varieties; this is also further emphasized by the fact that the pole beans are slower to mature than the dwarf, or bush, beans. The only argument that is usually advanced as a reason for growing pole beans is the fact that some varieties of pole beans are of a very superior quality, and, in some sections where a retail trade is willing to pay a fancy price for quality, their production is profitable. It is practically certain, however, that as the various varieties of bush beans are developed and improved, the pole bean will become less and less a type selected by the commercial vegetable grower.

17. The ideal commercial snap, or string, bean should possess the following characteristics: It should be quick growing, a heavy bearer, and of the true bush type, standing erect on a strong stem, and hold its crop well above ground so that the pods will not become soiled and rusty. The bean

itself, whether of the green or wax types, should have pods of good size, preferably from 4 to 6 inches long, should be either flat or round, according to the market demand, and thick fleshed and brittle, breaking without stringiness. Many varieties conform closely to these characteristics.

A large demand exists in nearly all markets for both the wax and the green snap beans. This is caused to a large extent by the difference in personal tastes, and to a less degree to a slight difference in their edible quality. The wax bean is often called a "butter bean," because of its appearance and a buttery flavor which some varieties possess. In the opinion of many, the wax varieties also present a better appearance than the green type when served—a strong point in favor of the wax bean by those who lay stress on the appearance of the beans on the table.

18. In order to obtain information regarding the commercial value of different varieties, extensive trials with the large number of varieties of beans offered by seedsmen have been carried on by the United States Department of Agriculture, through its bureau of plant industry. Quality was not considered in these tests, but special attention was paid to productiveness, good appearance, hardness, and shipping qualities—the points of most importance to commercial growers. As a result of these tests, the following varieties of bush green snap beans were listed as the best from the commercial point of view: *Extra Early Refugee*, *Late Refugee*, *Black Valentine*, *Red Valentine*, and *Giant Stringless Green Pod*. As the best of the bush wax snap beans the following varieties were selected: *Keeney's Rustless Golden Wax*, *Golden Wax*, *Davis Wax*, and *Bismarck Black Wax*. Both the *Hodson Green* and the *Hodson Wax* varieties have been omitted from the foregoing lists because of their poor quality, though they were included in the original government lists of recommended varieties. In view of the value of the *Wardwell Kidney Wax* bean, and the fact that it is one of the three most extensively grown of the wax varieties, it seems that this should be included in the list as a recommended variety.

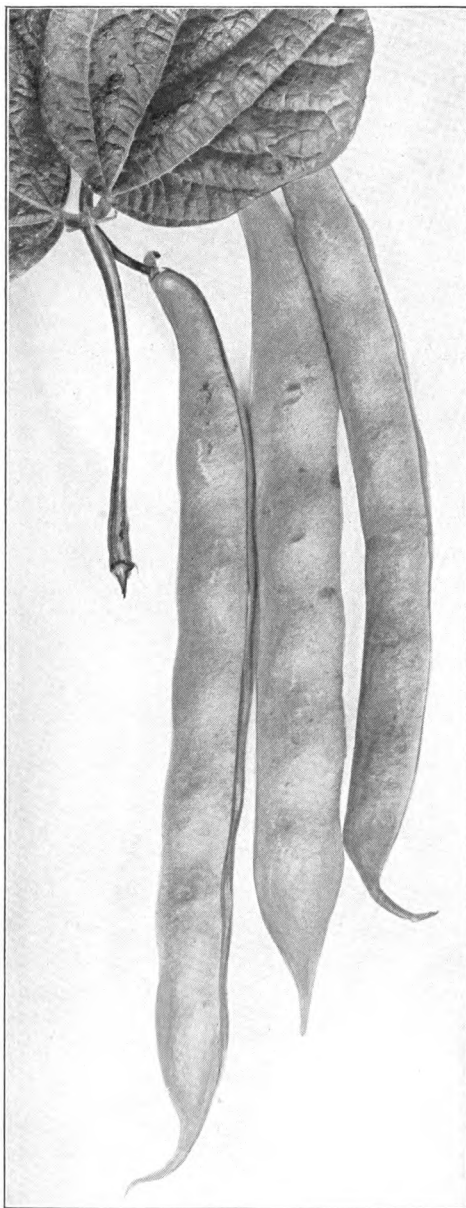


FIG. 5

**BUSH GREEN SNAP BEANS**

**19. The Extra Early Refugee** bush green snap bean, shown in Fig. 5, is one of the twelve most largely grown of the bush sorts. It is a quick grower, growing from seed to the marketable stage in from 46 to 48 days, and therefore, as its name implies, is considered an early variety. The plant is productive and fairly resistant to the attacks of rust (bean anthracnose). The plant is of medium size and hence can be planted in rows from 24 to 30 inches apart. The pods grow uniform in size, from 5 to 6 inches long, round and meaty, and somewhat stringy, but they are of good quality. This variety is listed by all of the leading seedsmen and should be tried by all growers producing green snap beans. It is used largely for canning.

20. The **Late Refugee** bush green snap bean is of two distinct types, the round podded and the flat podded. The round-podded type is the more popular of the two strains, and has largely replaced the flat-podded type. The round-podded type is one of the five most largely grown sorts of snap bean and the most popular late-season variety. This strain of the variety continues to bear for a long time, is very heavily productive, and is fairly free from anthracnose. The plant is very large, slender stemmed, and sends out many short runners. They should be planted in rows not less than 30 inches apart, and the plants should be allowed to grow somewhat thicker than the stronger stemmed kinds. The pods of the round type are very similar to those of the Extra Early Refugee, but are a little longer and a trifle thicker. This variety and the Extra Early Refugee can hardly be excelled for producing a smooth, fine appearing bean of fairly good quality. The Extra Early Refugee for an early bean and the round type of the Late Refugee for a late bean make a good combination for the trucker. For a private trade, a variety without any string in the pod would be more acceptable. The round-podded Late Refugee is sold by practically all seedsmen.

The flat-podded type of the Late Refugee is less tender, less productive, and more stringy than the round-podded type, and should not be grown where the latter is available.

21. The **Black Valentine** bush green snap bean is a variety extensively grown by market gardeners, especially in the South, but which sells on its appearance rather than on its quality. This variety is very productive, one of the most hardy, and an excellent shipper. It requires a season of about 50 days to produce a marketable product. The plant grows a little above medium in size and can be planted in rows from 24 to 28 inches apart. The pods are very uniform in size, are long, straight, round, dark green in color, and when full grown are tough, stringy, and of poor quality. In many markets, the Black Valentine is the first bean to come in and thus usually commands a high price. Later in the season it is usually replaced by a bean of better quality.

**22.** The **Red Valentine** bush green snap bean is considered to be the most extensively grown of any known variety. It has been a standard variety since 1865 and still holds its place as the leader; the variety as it first came out differed some-



FIG. 6

what from that now used. The Red Valentine will produce pods of a marketable size in 46 to 48 days and is heavily productive. The plant is of medium size and will allow of fairly close planting. The pods are uniform in size, from 5 to 6 inches

long, so meaty that the pods are creasebacked, that is, have a crease down the back, very brittle, of a medium green color, and somewhat stringy; they are of good quality and are not subject to serious injury by anthracnose; they will remain tender for a long time.

**23. The Giant Stringless Green Pod** bush green snap bean, a bush of which is shown in Fig. 6, is nearly identical with *Burpee's Stringless Green Pod* variety; both the pods and the general characteristics of the plants are nearly identical. This variety is very largely grown, is early to intermediate in season, and requires about 50 days to reach a marketable size. The plant is a little above medium in size and during its early growth is fairly erect, but later when weighted with pods it has a tendency to spread. The pods are not so uniform in size as those of the varieties previously described; they are long, usually about 6 inches, and are restricted in size between the seeds, which gives them a coarse appearance; they are round, deeply creasebacked, very brittle, have no strings, and are of excellent quality. This variety is somewhat subject to the attacks of bean anthracnose.

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#### BUSH WAX SNAP BEANS

**24. The Keeney's Rustless Golden Wax** bush snap bean is not extensively grown, but possesses characteristics that highly recommend it. The plant is large and spreading and should be planted in rows from 30 to 36 inches apart; when young, the plant sends out many runner-like branches, but this tendency ceases when the pods begin to set. The pods are brought to a marketable size in midseason, which means that from 50 to 55 days after planting a marketable crop can be secured. The bushes are very productive and continue to bear for a long season. The pods are medium in length, that is, from 5 to 6 inches long, straight, oval-flat, very brittle, are without strings, and of excellent quality. This variety is usually free from anthracnose. Its runner-like habit during early growth has tended to reduce its popularity among growers, but this habit rarely becomes troublesome in its culture.

**25.** The **Golden Wax** bush snap bean, shown in Fig. 7, is one of the leading varieties of the bush wax beans; it owes its popularity to being one of the most reliable bearers of the

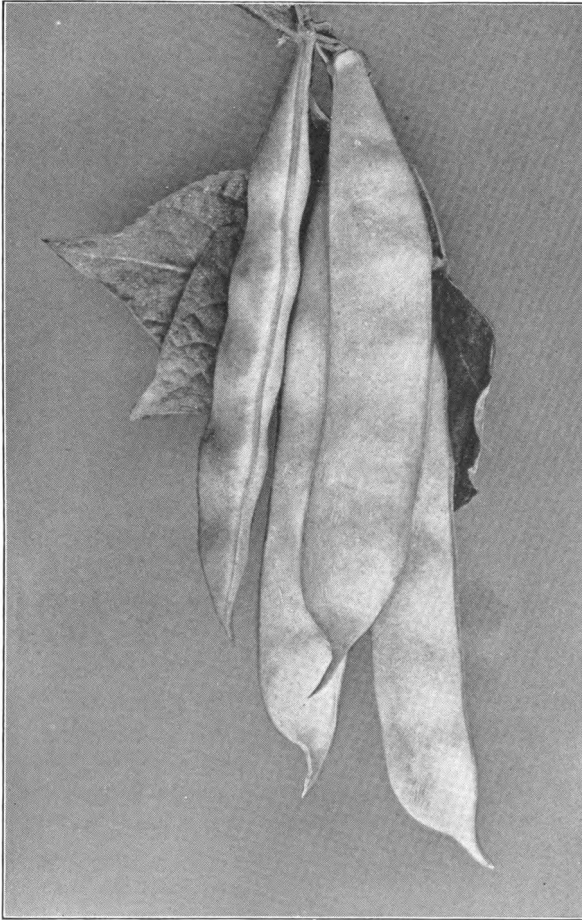


FIG. 7

wax bean varieties. The plant is small and grows stiffly erect and can, therefore, be planted close; the rows need not be over 24 inches apart. This variety is only moderately productive, the bushes bearing for a short time only; this is sometimes an

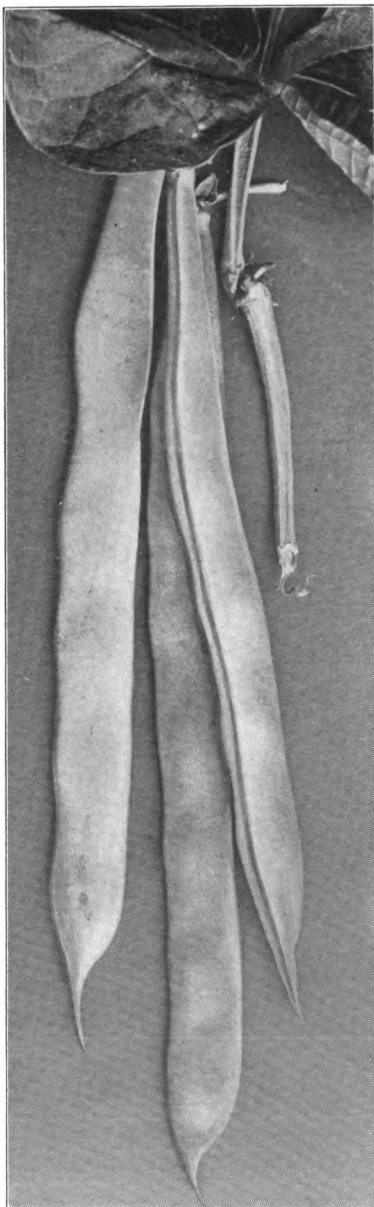


FIG. 8

advantage, for the crop can be quickly cleaned up and another put in its place. When in the snap-bean stage the pods are from 5 to 6 inches long, of a deep yellow color, somewhat oval in cross-section, uniform in size, brittle, without strings, and of excellent quality. This variety is, however, subject to anthracnose.

**26. The Davis Wax** bush snap bean, shown in Fig. 8, is one of the five most popular wax varieties. It is one of the most handsome of the wax varieties and one which is popular among growers because of its excellent appearance and shipping qualities. It is a very useful variety for the wholesale market. The plant grows somewhat above medium in size, very upright, and is a strong grower. The variety bears early, requiring from 6 to 7 weeks to produce snap beans, has a short bearing period, and is fairly productive. The pods are from 6 to 7 inches long, straight, flat, of a light yellow color, of only medium quality, rather stringy, subject to anthracnose.

**27.** The **Refugee Wax** bush snap bean consists of two types, the one stringless and the other stringy, both having some marked favorable characteristics. The stringless type has a plant that grows somewhat above medium in size, with a spreading habit, and sends out runners, during the early part of its growth, similar to those produced by the bushes of Keeney's Rustless Golden Wax bean. The crop matures rather



FIG. 9

late in the season, requiring from 7 to 8 weeks to reach a marketable size, but the bushes continue bearing for some time and are very productive. The plant is somewhat subject to anthracnose. The pods are of uniform size, from 5 to 6 inches long, of a light yellow color, and of excellent quality.

The stringy type very closely resembles the stringless type in the character of the vine and pod with the following exceptions: It is more productive and stringy, as the name indicates, is

more hardy, a somewhat more vigorous grower, and grows larger pods. Both of these types of the Refugee Wax bush snap bean are worthy of trial and will prove somewhat better adapted to northern sections than to the South.

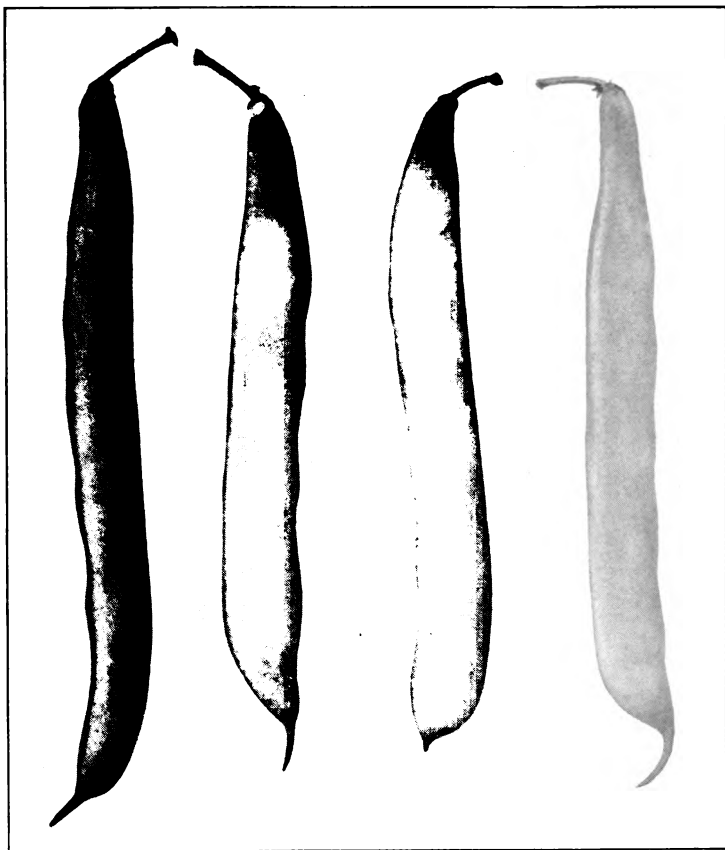


FIG. 10

28. The **Bismarck Black Wax** bush snap bean is another variety that is better suited for the wholesale than for the retail market, for although it is characterized by a handsome appearance, it lacks quality and cannot be recommended to the gardener who produces snap beans for a retail trade. At

present, this variety is not well known, but is desirable on account of its reliability in bearing, its hardiness, freedom from disease, and the handsome, even color and shape of the pods. The plant grows to a medium size, and grows erect without runners. It requires about 50 days to develop its pods to a marketable size, has a moderately long bearing period, and produces heavy crops. The pods are uniform in size, average about 6 inches in length, are round, brittle, stringy, and of only fair quality; the pods are somewhat curved, of a medium yellow color, and not very subject to the attacks of anthracnose.

**29.** The **Wardwell Kidney Wax** bush snap bean is one of the three most extensively grown wax bush snap beans and well deserves its place among the leading varieties. The plant of this variety is a medium to large grower and requires about 50 days to produce beans of salable size; the bush has a fairly long bearing season, and is very productive. The pods are remarkably uniform in size, from 6 to 7 inches long, flat, of a medium yellow color, brittle, stringless, and of good quality. The greatest drawback to the growing of this variety is its susceptibility to attack by anthracnose, which, in certain seasons renders the bulk of the crop unsalable. A plant with a good set of Wardwell's Kidney Wax beans is shown in Fig. 9. A detailed view of the beans is shown in Fig. 10.

An improvement over the Wardwell Kidney Wax bush snap bean is claimed for a recent introduction (1906) named **Burpee's Kidney Wax**. This variety is said to produce a heavier crop, to be as early, and to produce more handsome pods than Wardwell's Kidney Wax, the pods being straighter, more oval in cross-section, and less subject to injury by anthracnose.

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#### BUSH GREEN SHELL BEANS

**30.** Garden bush beans of the green shell type are few in number. The two varieties of chief importance are the Horticultural Bush, of which there are a number of strains, and the Improved Goddard. These green shell bush beans may be used either as snap or shell beans. They are not commonly known

throughout all sections of the country, but are important in the New England States.

**31.** The **Horticultural** bush bean, of which there are a number of strains, is one of the standard variety types of the country, and one of the most important beans that can be used both as a snap and as a shell bush bean, as it combines high quality in both stages—a rare characteristic. The plant grows erect, medium in size, of compact form, and is fairly resistant to anthracnose; it may be planted in rows from 24 to 30 inches apart. Beans of this variety should be planted somewhat later than the ordinary snap beans; in the latitude of New York, May 15 will be about the proper time for planting. From 46 to 48 days will be required for this variety to reach the snap-bean stage, and from 2 to 3 weeks longer, or from 60 to 70 days, to reach the shell-bean size. When at the snap stage the pods are from 5 to 6 inches long, uniform in size, flat and slightly curved, of compact form, of a dark green color, of medium to good quality, and practically stringless. As the beans approach shell size, that is, mature, the pods turn yellow and become splashed and streaked with red, making a strikingly handsome pod. The bean itself is white, striped with red. A good strain of this variety will yield a large crop of good-sized beans and on an average the pods will contain from five to six beans.

**32.** The **Improved Goddard** bush bean is not as extensively planted as the Horticultural bush bean, but it excels the latter in some particulars. The Improved Goddard is the most productive of this type of combination snap and green shell beans, and grows the largest and most handsome pods. The plant is large and long stemmed, and should not be planted as close as the Horticultural bush bean; it bears its crop rather late in the season, requiring probably about 10 days longer than the Horticultural bush bean to bear a marketable crop either of the snap or the shell beans; it is practically free from anthracnose. The pods are very uniform in size, very long, averaging about 7 inches, straight, flat when in the snap-pod stage, and

tough and stringy; when it approaches the green-shell stage, the pod becomes light green in color and splashed with bright red. Both the climatic conditions and the market demand are better for this bean in New England than elsewhere.

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#### POLE GREEN SNAP BEANS

**33.** The pole varieties of garden beans include four types: The green snap, the wax snap, the Horticultural (green shell) or red-podded shell, and the lima. In the following pages only the varieties that are most profitable for market will be discussed.

Of the green snap type of garden pole beans the following varieties are usually considered to be the most profitable to grow: *White Creaseback*, *Kentucky Wonder*, *Lazy Wife*, and *Scotia*. Of the wax type of garden beans the following are the most highly recommended: *Kentucky Wonder Wax*, and *Golden Carmine Podded Horticultural*. Of the green shell type of garden beans the following are the most satisfactory: *Golden Carmine Podded Horticultural*, *Childs Horticultural*, *Worcester Mammoth*, and *Dutch Case Knife*.

The pole kidney bean vines are generally somewhat more luxurious growers than the bush kidney bean. The beans are also larger than the beans of the bush varieties and are borne more abundantly.

**34.** The **White Creaseback** green snap pole bean is a variety raised extensively by market gardeners in the South, but is little known in the northern half of the country. Two recognized types of this variety are grown, the early and the late. The early type is far more valuable than the late type, and for that reason only the early type will be described. The vine is small and at first bush-like; later it sends out tendrils and climbs well; it is very early and only fairly productive. The snap pods are uniform in size, about 6 inches long, smooth in surface, round in cross-section, deeply creasebacked, brittle, somewhat stringy, but of good quality, and not likely to be damaged by anthracnose.

35. The **Lazy Wife** green snap pole bean will be found listed by most seedsmen in the country, and ranks among the first five pole beans in popularity. The vine grows large, is a poor climber when young, but improves in this respect as the

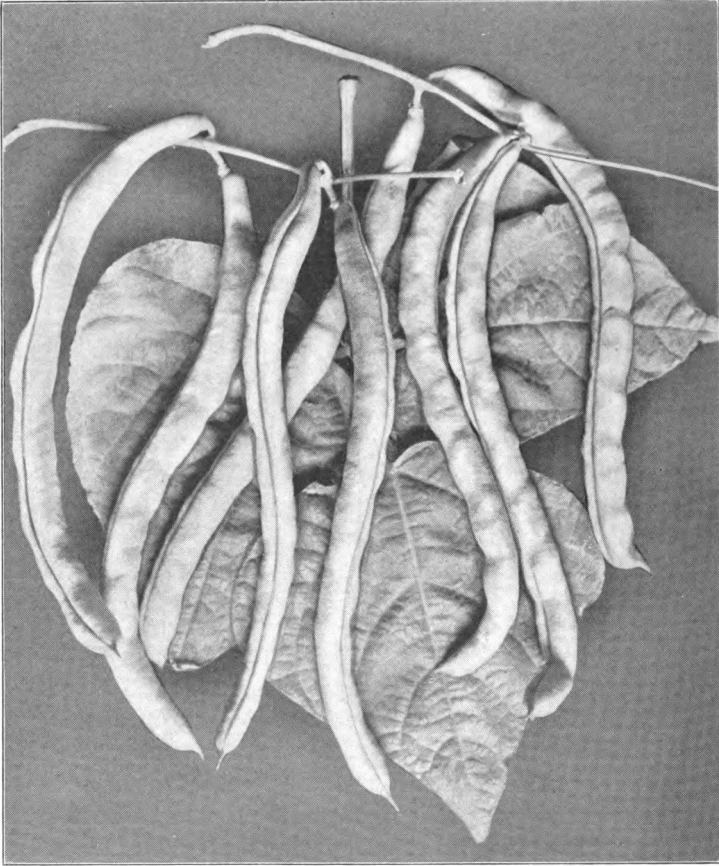


FIG. 11

season advances; the vine is late in bearing its crop, long bearing, and very heavily productive. The snap pods are from 5 to 6 inches long, uniform, flat but bulging at the seeds, brittle, stringless, of good quality, and practically free from anthracnose.

**36.** The **Kentucky Wonder** is the most widely distributed and best known of the green snap pole beans. The vine makes a medium growth, is very early, and productive. The snap pods are of uniform size and shape, very long, from 8 to 9 inches, and considerably curved; they are deeply creasebacked and have a coarse-appearing surface; they are very brittle, have a small string, and are of good quality. This bean is very popular in the home garden because of its large size, good quality, and heavy yield. For the best market trade it is too coarse and is known in some markets as the *snake bean*. Specimens of the Kentucky Wonder bean are shown together with a few leaves of the plant in Fig. 11.

**37.** The **Scotia** green snap pole bean, although little known and cultivated, is considered to be one of the two best varieties of late pole green snap beans. The vine makes a large growth, climbs the poles well, requires about 2 months to come into bearing, and is heavily productive. The snap pods are very large, averaging over 7 inches long, are very uniform, straight, round in cross-section, deeply creasebacked, and have a very smooth, glossy surface; they are brittle, stringy, of good quality, and little attacked by anthracnose. This variety is listed only by a few seedsmen, but deserves greater prominence than it has yet received.

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#### POLE WAX SNAP BEANS

**38.** The **Kentucky Wonder** pole wax snap bean is not largely grown but seems to be gaining in popularity, especially in the South. This variety is an early sort that grows a rather small vine, is a good climber, and yields a moderate crop. The snap pods are a whitish yellow, about 8 inches long, slightly curved and bulging at the seeds, as does the green Kentucky Wonder. The snap pods are fleshy, brittle, and of good quality, but are subject to the attacks of anthracnose. For the home garden, for a retail trade, or for a market that is not overly particular with respect to appearance, this variety is excellent. It has the same objections as has the green Kentucky Wonder.

**39. The Golden Carmine Podded Horticultural** pole wax snap bean is another variety that is comparatively new but that is gaining in popularity. Some authorities have described it as the best all-round pole sort for the production of wax snap beans and green (fresh) and dry shell beans. This, of course, makes an extremely satisfactory combination for the home gardener. The vine is only a moderate grower, climbs the pole well, bears for a moderately long period, and yields heavy crops. The snap pods are very long, not uniform in shape, flat and rather crooked, of a light yellow or yellowish-green color, sometimes streaked with red, brittle, without strings, of good quality, and not troubled by disease. The shell pods are of a light yellow, streaked with red; the pod is much sunken between the seeds and is not often as fully colored as is wanted for choice Horticultural varieties. When well grown this variety is one of the most satisfactory of the red-podded green shell varieties, but the local climatic and soil conditions have much to do with its success or failure.

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#### POLE GREEN SHELL BEANS

**40.** Of the pole green shell bean varieties, the **Golden Carmine Podded Horticultural** bean, which has been described under the head of pole wax snap varieties, is of distinct value. In addition to this the following varieties are important:

**41.** The **Childs Horticultural** pole green shell bean is but little known outside of New England, but it is of considerable commercial importance where the Horticultural type of green shell bean is desired. The vine grows large, and climbs poorly at first, but later in the season improves in this respect; it bears late in the season, has a long bearing period and produces heavy crops. The snap pods are of little importance. The green shell pods are attractively colored with bright red, are about 6 to 7 inches long, and are fairly smooth.

**42.** The **Worcester Mammoth** pole green shell bean is another of the red-podded green shell type that is not extensively grown and that succeeds best in the New England States; this,

however, does not mean that when the variety has had sufficient trial it may not prove successful elsewhere. The vine grows large and is only a fair climber; it bears late in the season, bears for a long time, and yields a good-sized crop. The snap pods are of fairly good quality. The shell pods are well shaded with red, are about 7 inches long, and are somewhat depressed between the seeds. This variety is a somewhat uncertain cropper, but when proper attention is given to cultural details it stands in the front rank of the Horticultural class; this variety and the Golden Carmine Podded Horticultural closely resemble each other in many respects.

**43.** The **Dutch Case Knife** pole green shell bean is one of the most generally known and planted of the kidney pole beans. It is not a red-podded variety, but is a leading green shell variety in many sections of the country outside of New England; it is especially popular in the Middle West. The vine is a strong grower and a good climber; it is a little late in coming into bearing, but continues to bear for a good length of time and yields moderately large crops. The snap pods are of very poor quality. The green shell pods are green in color, with an occasional splash of purple; the pod is greatly contracted between the seeds and averages about 8 inches in length.

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#### SEED AND SEED PRODUCTION

**44.** The plants for seed production are grown in much the same way that the crop of snap beans are grown, except that they are usually allowed a little more space in the field. Instead of being picked while immature, however, the beans are allowed to attain full size in the pods, and the vines are allowed to become yellow and show signs of drying up before the crop is harvested.

At harvest time, the plants are usually mowed down, forked over to stand bottom end up so the pods will be exposed to the sun, and allowed to dry out and cure for several days. The condition of the weather has much to do with the success of this operation, dry weather being essential. Sometimes the

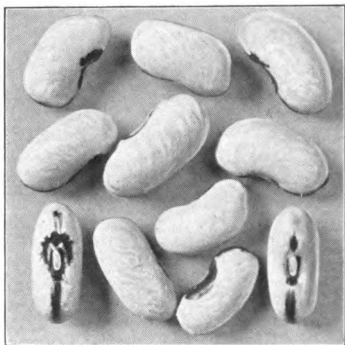


FIG. 12

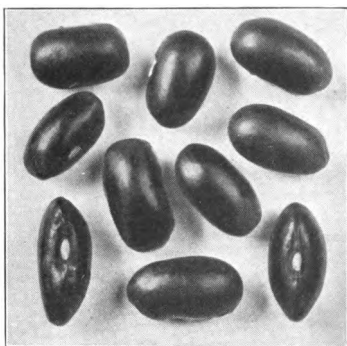


FIG. 13

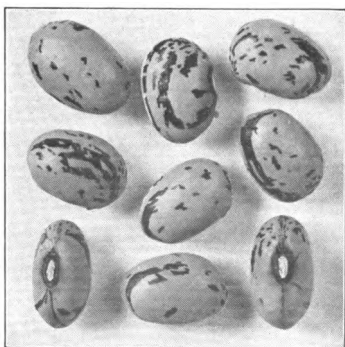


FIG. 14

vines are dried in piles in the field. When the drying process has proceeded far enough the vines are either placed in stacks similar to hay stacks or stored in a barn. The threshing is done either with a hand flail or with a regular threshing machine, and the seed is then run through a winnowing machine to blow out the chaff and dirt. Good grades of seed are hand picked to remove all irregular and deformed seeds.

**45.** Bean seeds are among the largest of the garden seeds, only from 200 to 250 being required to weigh 1 ounce; 1 quart of bean seed will weigh between 24 and 33 ounces. Samples of kidney bean seed are shown in Figs. 12, 13, and 14, and a sample of lima bean seed is shown in Fig. 26. In Fig. 12 is shown seed of the Wardwell Kidney Wax bush bean; in Fig. 13, is shown seed of the Giant Stringless Green Pod bush bean; and in Fig. 14 is shown seed of the Dwarf Horticultural bean.

Bean seeds are comparatively long lived. The average period of satisfactory germination is about 3 years, with an extreme limit of about 8 years; few commercial growers, however, use

seed more than 1 or 2 years old. Bean seed germinates rather quickly, usually in from 3 to 12 days; the condition of the soil has much to do with this. A few kidney bean seedlings with the cotyledons attached are shown, natural size, in Fig. 15; lima bean seedlings are shown in Fig. 27. To be considered of a good grade, bean seed should be 99 per cent. pure, and about 98 per cent. of the seed should germinate.

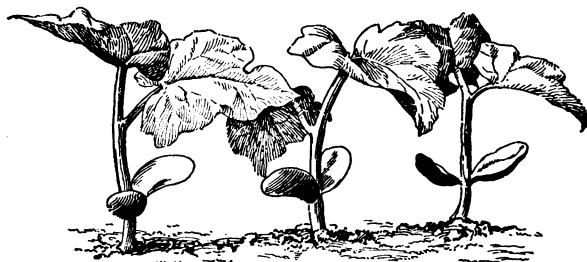


FIG. 15

46. The quantity of bean seed required to plant 1 acre will vary with the system of planting employed. When the rows are spaced about  $2\frac{1}{2}$  feet apart and three or four beans are dropped in a place in hills spaced 18 inches apart in the row, from 10 to 12 quarts of seed will be required to plant 1 acre, and about 4 ounces to plant about 100 feet of row. When the rows are spaced  $2\frac{1}{2}$  feet apart and the beans are dropped from 2 to 3 inches apart in the rows, from  $\frac{3}{4}$  to  $1\frac{1}{2}$  bushels of seed will be required per acre, and about 1 quart per 100 feet of row.

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### PLANTING

47. **Preparation of Soil.**—The market gardener rarely plans any rotation for beans. This crop is usually planted wherever there happens to be vacant space, the main consideration being whether or not the crop will have time to mature so as to be marketable at the right season. Beans are rarely the first crop of a season on a market garden. In the North, the land is usually first planted to lettuce, radishes, etc., and

then after these crops have been taken off and the soil has been warmed up, beans are planted. In the South, beans are planted after such crops as spinach have been taken off the land, and then after the beans are harvested another crop is put in for harvesting in the fall. For field beans, the problem is different. Both 3-year and 4-year rotations are used. A satisfactory 3-year rotation is clover, beans, and wheat. A good 4-year rotation, where conditions are favorable, consists of clover, corn, beans, and wheat. The Michigan Agricultural Experiment Station recommends a 4-year rotation in which a mixture of Red Clover, Alsike clover, and Timothy is first sown, a hay crop being cut the first year, the land pastured the next, then the beans planted on the inverted sod, and followed by wheat.

The land on which beans are to be planted requires the ordinary preparation that is given for any garden crop. This means (1) that a liberal application of stable manure and fertilizer should be made, varied, of course, according to the past treatment the land has received; (2) that the plowing and tillage should be deep and thorough; and (3) that the surface soil should be smoothed off level and freed from obstructions that might interfere with planting.

**48. Time for Planting.**—In the latitude of New York, the first planting of beans will usually be made about the last week in April or the first week in May, and, as previously stated, the beans will usually follow some other crop on the land. The time of sowing the first crop will vary in different localities according to the latitude and elevation. Only the most hardy varieties should be used for this first planting and any possible local advantage of climate or altitude should be taken advantage of. No expectation should be entertained that this first planting will always escape total destruction, or even injury, by frost. The first planting is usually followed in about 1 week by a second planting on another plot of ground, and 1 week later by a third planting. This is the safest way to provide a crop for market at the earliest possible date and to make sure that one crop at least will hit the market at a good time to secure top prices. For the later crops of beans successive

plantings are continued at intervals of 1 week until about July 1. Such a plan should supply a local market with snap beans from the time of the first picking until the plants are killed by the frost in the fall. Some variations are made in the dates for planting because of variation in the characteristics of the varieties planted, but the same object is always striven for, that is, to have snap beans early in the market and continuously from then on throughout the season.

In order to produce a crop that will enter the market before the northern crop, the trucker in the South Atlantic States often plants a hardy variety of snap beans at so early a date that considerable risk from frost is involved. Successfully brought to maturity, such a crop will usually return handsome profits, but the excessive risk will limit his average net profit over a series of years, because of the necessarily larger acreage that is planted. The northern grower plants small areas and takes fair profits on small crops. Because his crop will sell at a good profit only early in the season, the southern grower plants a large early acreage, makes large profits when the crop matures, and suffers large losses when the crop fails.

**49. Distances for Planting.**—Garden bush snap beans are planted in rows from 2 to 3 feet apart. Fields planted with bush beans are shown in Figs. 3 and 22. The richness of the soil and the method of cultivation have an influence on the distance between the rows. On poor soil, beans should be planted closer than on rich soil, and when horse cultivation is to be practiced the rows should not be planted closer than 30 inches apart. The bean seed should be planted from 2 to 4 inches apart in the rows, or if it happens to be planted thicker than that the plants should be thinned to that distance apart in the rows after they come up. The seed should be covered with about 2 or 3 inches of soil, but no more or the young plants may have difficulty in forcing their way up. The quantities of seed required for sowing 1 acre have been previously given.

**50.** As the growth of the pole plant is more vigorous than the growth of the bush plant, a greater distance between plants will be necessary. The hills may be spaced 3 feet by 3 feet or

4 feet by 4 feet, or the rows may be spaced from 3 to 4 feet apart and the poles spaced from 2 to 3 feet apart in the row. Whether the poles are set before or after planting makes little difference, except that setting them before planting is usually considered to be more convenient. If the poles are set before planting, five or six beans are planted about 2 inches deep around the pole and then dirt thrown over them with a hoe; frequently the seeds are planted in little mounds of earth in order to secure good drainage. If the poles are to be set after planting, the practice is to scatter the seed in the hill and, either before or after the seedlings have come up, the pole is set; a hole can be made for the pole with a crowbar and the pole set with little interference with the growing plants. When pole beans are grown on a trellis the rows are generally spaced 4 feet apart and the vines are spaced about 18 to 24 inches apart in the row.

Pole beans are usually cultivated by horse-drawn tillage implements unless considerable intercropping is carried on.

51. The poles for supporting pole beans will usually measure from  $\frac{3}{4}$  inch to 2 inches in diameter and 8 feet long. Usually,

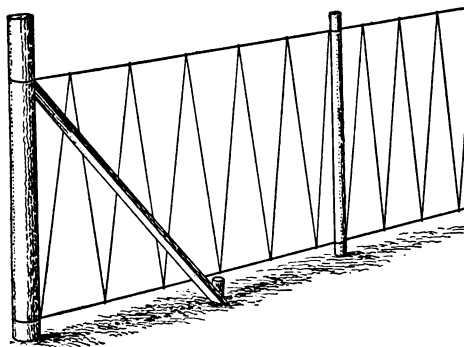


FIG. 16

the pole is a sapling cut for the purpose. When set, the pole is buried about 2 feet in the ground.

When pole beans are planted in drills they are not supported on poles but on a trellis. The trellis may be made of galvanized-wire poultry netting

6 feet high stretched on poles. A cheaper trellis may be made by stretching wires on posts as follows: At each side of the field and at the ends of each row, stout posts that will extend 6 feet above ground are set and strongly braced. At intervals of 10 to 12 feet along the row, lighter posts are set.

Two heavy wires are stretched along the poles, one near the top and the other a few inches from the ground. Binder twine or some similar material is then zigzagged between the two wires, and forms the support on which the vines may climb. A trellis made in the manner just described is shown in Fig. 16.

**52. Details of Planting.**—Where bush beans are planted extensively, horse-drawn corn planters fitted with a bean plate, or a device made especially for dropping beans from the machine are used. These machines plant two rows at a time and mark the location of the next row. With such a machine the depth of planting can be readily regulated from 1 to 3 inches deep. This is sometimes an important point, because the depth of planting depends on the soil and season. Early in the spring when the earth is not thoroughly warmed up and when the season is likely to be wet, the shallower planting is advisable. In midsummer and in a light soil the deeper planting may be necessary to secure enough moisture for germination.

Bush beans can also be planted with hand seed drills, but planting in this way on a large scale is rarely satisfactory, because only one row can be planted at a time, and the seed cannot be planted deep enough. Some growers prefer to plow out a shallow furrow and scatter the beans in the bottom of it by hand. The seed is then covered with a hoe. Such a method will usually produce good results, but the labor cost is higher than when machines are used for planting.

**53.** When planting bean seed, the peculiar characteristics of this seed should receive careful attention or the best results may not be secured. Bean seed, as compared with other seed, is very large and oily and of such a nature that it will spoil quickly when placed in uncongenial surroundings like those found in a cold, wet soil. The method of germination is also peculiar. The two cotyledons, or halves, of the bean are lifted above the surface of the soil during the process of germination, that is, they are if conditions will permit, and serve as the first two leaves of the plant. These cotyledons are, in fact, storage organs that contain concentrated plant-food for the nourishment of the young seedling and thus serve a purpose similar

to the fleshy roots of some crops. Because of this habit of growth the soil above the bean seed must be loose and friable, and no crust should be allowed to form. The size of the bean seed is such that considerable force is required to force the cotyledons through even a loose soil, and if to this is added the extra resistance of a crust, the bean stalks may never force their way through, or if they do the plants may be greatly weakened by the effort and rarely live. Hence, any crust that forms on a soil should be broken up immediately. This can usually be done without injury to the crop by a garden rake or even by a horse weeder, but this must be done before the beans show above ground. Kidney bean seedlings in an early stage of their growth and with the cotyledons showing are illustrated in Fig. 15.

**54.** The statement is commonly made by uninformed persons that bean seed should always be planted with the seed eye down. Obviously, however, this would not be possible for the commercial grower who plants a large area, because such a practice necessitates hand work. Fortunately, this is not necessary for quick and uniform germination. In the home garden, planting the bean seed with the eye down, especially if the soil is heavy, may be advisable; this, however, applies with more force to lima than to kidney beans.

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### CULTIVATION

**55.** Cultivation of beans begins as soon as the seed has been put in the ground; that is, cultivation is necessary before the seedlings come up if a rain has caused a crust to form on the surface of the soil. To produce good plants, this crust must be broken up immediately even at the risk of destroying some of the plants, or, as previously pointed out, the entire field of plants may be weakened or even lost.

Subsequent tillage should consist of frequent stirrings of the ground by either horse or hand cultivators. The first few cultivations may be deep early in the spring; the later cultivation should be shallow, as deep cultivation, after the roots have

grown out into the spaces between the rows, will destroy many roots and greatly injure the plants. A spike-tooth cultivator is always best for cultivating beans, and shields to protect the young plants from being covered with dirt are necessary. Beans that have been planted shallow should be ridged slightly, perhaps 1 or 2 inches, at the last cultivation in order to aid the plants in supporting the crop. Deep-set plants will not require such ridging.

An important point to bear in mind in cultivating beans is never to cultivate them when the plants are wet with dew or rain, as this will greatly assist the destructiveness of the disease that attacks them.

**56.** The bush bean may often be used to advantage as a succession or as a companion crop. It can be planted shortly before a crop of sweet corn is taken from the field and will have time to mature a crop before frost. It is a good crop to follow an early spring crop like radishes or spinach, and as it will usually mature a crop when planted about the middle of July, it may be made to follow a midsummer crop to good advantage. As the bush bean will grow well in a light shade, it is an admirable crop to grow in an orchard. It has also been used to plant between rows of strawberries the first year; whether or not this practice has a desirable effect on the strawberries, however, is a matter of dispute.

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## INSECT PESTS AND DISEASES

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### INSECT PESTS

**57.** The insects that do particular damage to the growing bean plant are comparatively few in number and are found mostly in the southern parts of the country. Of the pests that attack the growing plant, the following are the most important: The *blister beetle*, the *bean ladybird*, the *bean leaf beetle*, the *bean leaf roller*, and the *flea beetle*.

**58.** The *blister beetles*, shown in Fig. 17, although they are fairly well distributed over the country, do their chief

damage in the South. The one shown in (a) is the most destructive; it is found well distributed over the eastern section of the country and as far west as Kansas and Nebraska. The blister beetle shown in (b) is less troublesome; it is found principally in the country between the Mississippi River and the Rocky

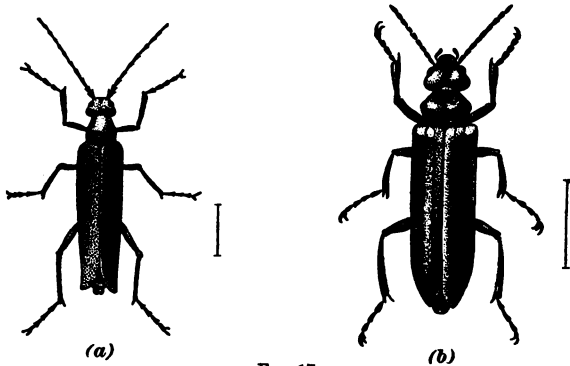


FIG. 17

Mountains, in the Missouri Valley, and in the Northwest. These beetles eat the leaves of the plants and may be destroyed by almost any poisonous insecticide; arsenate of lead (2 pounds of arsenate of lead paste to 50 gallons of water) is effective.

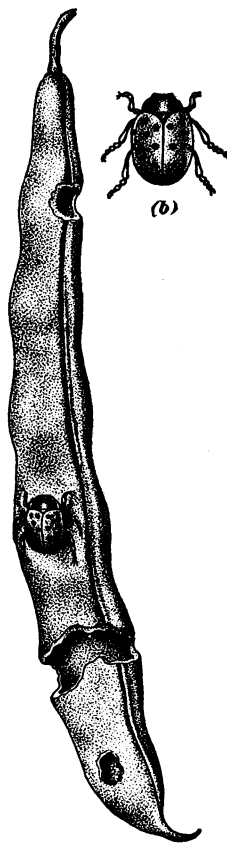
**59.** The **bean ladybird** is also often called the *spotted bean weevil*. This insect is shown in Fig. 18; in (a) the insect is shown on a bean pod that it has injured; in (b) the insect is shown somewhat enlarged. This insect usually appears early in the summer, in June or July, and lays its eggs. One brood develops, and the mature insect winters in convenient, protected spots. This insect eats all parts of the bean plant and can be killed with an arsenical poison.

**60.** The **bean leaf beetle**, shown in Fig. 19, is injurious in the Gulf States; the adult beetle is shown in (a) and the larva in (b). It is about  $\frac{1}{4}$  inch long and half as wide; it is of a reddish brown color with black markings. The damage done by this insect is caused by eating holes in the leaves. Spraying with an arsenical poison is thus an effective method of control.

61. The **bean leaf roller** seems to be confined to the South Atlantic States. It is a leaf eater and its effect on the foliage of the plant makes it difficult to combat unless steps are taken to kill it before it has had a chance to do much damage. A stomach poison, such as arsenate of lead, Paris green, etc., applied to the foliage of the plant will destroy this pest.

62. The **flea beetle**, the same insect that attacks the potato plant, also attacks the plant of the garden bean. Spraying with Bordeaux mixture (4 pounds of copper sulphate, 5 pounds of stone lime, water-slaked, 50 gallons of water), is the best preventive; the presence of this spray on the leaves seems to repel the insect rather than to do it any injury.

63. Dry beans are subject to the attack of a number of **weevils**, and the larvas of these develop to a considerable extent after the beans are in storage. This type of pest does not injure the plants or even the beans during the time of growth or when sold as green shell or snap beans, but injures the seed during the winter and may thus be the cause of poor seed. A general remedy for all weevils that attack beans is fumigation in air-tight bins with carbon bisulphide; this is a gas heavier than air and is highly inflammable; hence, it is important to keep fire away from it. The method of fumigating with this gas is as follows: Provide 1 pint of liquid carbon bisulphide for each 1,000 cubic feet of air space in an air-tight bin. After the beans have been placed in the bin, sprinkle the carbon bisulphide over the top of the beans and



(a)  
FIG. 18

cover the top of the bin securely. The liquid will quickly vaporize, and the gas will settle through the spaces between

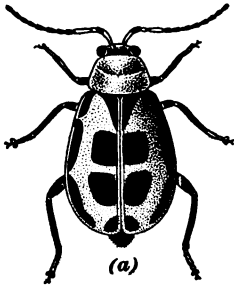


FIG. 19

will hold about 5 bushels of beans, and about 3 ounces of the liquid carbon bisulphide will be sufficient for pouring over the beans. A tight lid should be provided for the barrel.

#### DISEASES

64. The most serious disease of beans is *anthracnose*; the minor diseases attacking this plant are *bacteriosis* and *mildew*.

65. *Anthracnose*, also often called *rust*, *blight*, *pod spot*, and *speck*, is the most serious fungous disease of the bean plant. Bean pods attacked by it are shown in Fig. 20, and leaves attacked by it are shown in Fig. 21. On some varieties the disease is so destructive that the beans are of little value commercially; other varieties seem to be more or less immune to the disease. The disease is usually carried over from one season to the next on the seed. It may attack a plant in the seedling stage and cause dark-colored sunken spots on the stem; so much tissue may be destroyed in these spots as to cause the top to fall over of its own weight; this will, of course, prevent a good stand of plants. At other times, the disease

may not appear until the pods are nearly of marketable size; then it usually attacks the pod, and during wet weather may spread rapidly through a patch.

The dark, sunken spots in the bean pods caused by the disease are very characteristic. At times, a light-colored, rather

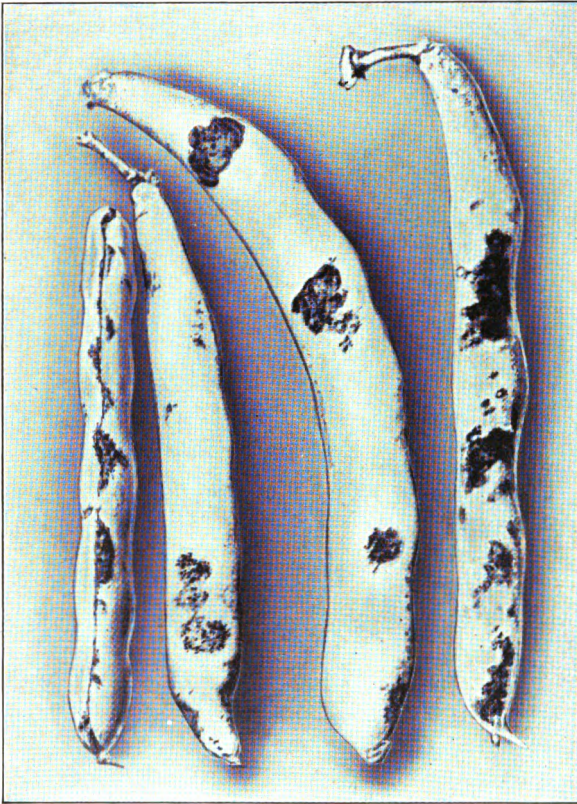


FIG. 20

pinkish spot will be found in the center of the dark spot; such a light-colored spot is caused by the presence of ripened spores. These spores spread rapidly in drops of water, and this accounts for the rapid spread of the disease among plants that are cultivated while they are wet.

Preventive treatment for this disease is the only practical method of control; curative measures are almost impossible, for once established it is difficult to eradicate. The planting of seed free from fungous spores of this disease is an important preventive measure. To be sure that no spores are on the seed, is, however, impossible. Soaking the seed in formalin, so efficacious in the destruction of most fungous spores on seeds, does not guarantee immunity. The selection of rust-resistant varieties for planting is probably the safest



FIG. 21

plan of avoiding loss from this disease. About three sprayings with Bordeaux mixture (4 pounds copper sulphate, 5 pounds of stone lime, water-slaked, and 50 gallons of water), will do much to reduce the seriousness of an attack of anthracnose. The first spraying should be given about the time the third leaf is developing and should be twice repeated at intervals of 2 weeks.

**66. Bacteriosis** sometimes attacks both kidney and lima beans. The disease is caused by the growth of bacteria in the plant tissue and affects both the leaves and the pods. The

presence of the disease is marked by the appearance of water areas on the leaves and pods, and these gradually increase in size until whole plants are destroyed; these watery areas are often bordered with a pinkish rim and the surface of the area may become amber colored. Thorough spraying with Bordeaux mixture, as recommended for anthracnose, will do much toward controlling this disease.

**67. Mildew** is a fungous disease that is very destructive to lima beans of certain varieties. It becomes most troublesome in wet seasons and on low land. Close planting and very heavy foliage will favor the development of mildew. Spraying with Bordeaux mixture as previously described is a good preventive.

**68.** Several other fungous diseases of the bean of lesser importance are found. They are all subject to control by the timely use of Bordeaux mixture.

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#### HARVESTING AND MARKETING

**69.** Garden beans are harvested by hand as soon as they have reached the proper stage of growth. This stage has been reached when the pod is full length but before the beans have begun to bulge the pod. The picking is customarily done by piece work, usually by young boys and girls or women; in the South, negroes do most of the picking. Pickers at work in a field of snap beans are shown in Fig. 22. The price paid for picking will average about 15 cents per bushel. The special harvesters used for gathering the field crop cannot be used on garden beans.

**70.** To maintain the production of snap pods over as long a time as possible, the pods should be picked frequently and all the large pods should be picked off cleanly; the small pods should be allowed to remain until they become filled out. By this means the seeds are prevented from maturing and the life of the plant is prolonged. The ripening of the seed takes a great deal of the vitality of the plant and shortens its life.

By careful attention to picking, which may, of course, be practiced to best advantage in the home garden, a continuous supply of snap pods can be secured for several weeks from the same plants.



FIG. 22

**71.** The quickest growing sorts of garden beans can be harvested about 45 days after planting; these are commonly called 6-week beans. Other varieties of snap beans take as long as 60 days to reach a marketable size, and some longer.

**72.** The prices of string beans, or snap beans, vary according to the supply, the season of the year, and the quality of the product. The demand for this vegetable is very constant and seems to be increasing, and larger and larger quantities are being used in the winter, when other vegetables are rather scarce. During the season when the local beans are being sold by hucksters in a local market the prices are fairly uniform, but when the beans are out of season and have to be shipped in from southern points the prices are likely to be uniformly high in small markets and subject to wide fluctuations in the large markets. This, of course, is true of all perishable vegetables. In the New York markets, beans are now commonly sold by the bushel hamper, a sample of which is shown in Fig. 23, although formerly some of the shipments from southern localities were made in crates.

The fluctuations in the prices for string beans are wide in almost every month. During December, January, February, March, and April, the average prices for string beans in the New York markets are much higher than during the other months of the year. May, June, and November are months of both extremely low prices and fairly high prices, while September and October seem to have the lowest average prices of any months in the year, although the prices are only fair in July and August. Table I shows the extreme low and high prices and the average low, and high prices per bushel basket for string beans in the New York wholesale markets for the 10 years from 1903 to 1912, inclusive. These prices are figured from the average of the low and high prices on the first and fifteenth of each month for the 10 years in question. In marketing string beans, the grower should bear these monthly fluctuations in mind, as the profit at the low prices is very meager.

In small local markets, all snap, green, wax, and shell beans are sold by the bushel or quart. The prices vary from 30 cents a bushel for snap beans in times of glut to about \$2.50

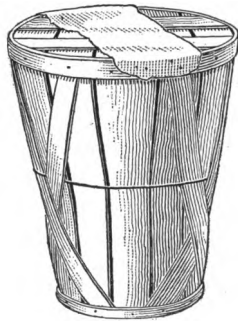


FIG. 23

and higher per bushel in times of shortage during the local season. For the out-of-season snap beans, as previously shown, the price often goes to several dollars per bushel. When shipped long distances, the beans are usually marketed in bushel

**TABLE I**  
**PRICES OF STRING BEANS IN THE NEW YORK MARKETS**

Month	Per Bushel Basket			
	Extreme Prices		Average Prices	
	Low	High	Low	High
January . . . . .	\$0.50	\$9.00	\$1.53	\$5.23
February . . . . .	.50	8.00	1.40	5.08
March . . . . .	1.00	6.00	1.63	4.70
April . . . . .	1.00	6.00	1.30	4.20
May . . . . .	.25	4.00	.75	2.75
June . . . . .	.10	4.00	.28	2.80
July . . . . .	.10	2.00	.27	1.25
August . . . . .	.15	2.50	.43	1.63
September . . . . .	.25	1.50	.33	1.13
October . . . . .	.15	1.50	.29	1.12
November . . . . .	.10	6.00	.46	2.95
December . . . . .	.25	9.50	.90	4.55

baskets or hampers, and when sold in the local market they are often sold in  $\frac{1}{2}$ -bushel baskets or miscellaneous packages.

Shell beans usually bring a higher price in the market, but the advantage of this is somewhat offset by the higher cost of production. The price of shell beans in a good local market will vary from 50 cents to \$2.50 per bushel.

## LIMA BEANS

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### VARIETIES

**73.** The **lima beans**, like the kidney beans, are divided into two classes, bush and pole. As with the pole sorts of kidney beans, the pole limas are longer in coming into bearing and are more heavily productive than the bush sorts. A classification of lima-bean varieties based on the size of the seed is sometimes made in both the pole and the bush varieties, the three divisions being: the large, the medium, and the small-seeded sorts.

The largest and latest maturing kinds of lima beans are not found to be suitable for the northern sections of the United States, because of the shortness of the growing season in these parts.

**74. Bush Lima Beans.**—The varieties of bush lima beans that can be most highly recommended are: the *Wonder Bush*, the *Wood Prolific Bush*, the *Dreer Bush*, and the *Burpee Bush*. The first two of these varieties are comparatively new and little known, although they possess qualities that merit their further cultivation. The last two named varieties are well known and are extensively grown.

**75.** The **Wonder Bush** lima bean was introduced to the trade in 1898 and has been called the best of the large-seeded bush lima beans for general cultivation. The plant grows large, erect, and compact; it bears its crop in mid-season, has a long bearing period, and produces a heavy crop. The shell pods are a dark green in color, flat, very uniform in size, and long for bush limas, averaging a little longer than 4 inches; the pods usually contain three or four beans.

**76.** The **Wood Prolific Bush** lima bean bears smaller seeds than the variety just described, but it matures its crop earlier in the season. The plant grows to a medium size, has a long bearing period, and is a heavy producer. The green shell pods are of a dark-green color, have a smooth surface, are uniform in shape, are of medium size, and are very flat; they average about  $3\frac{1}{2}$  inches in length and contain from three to four seeds to the pod.

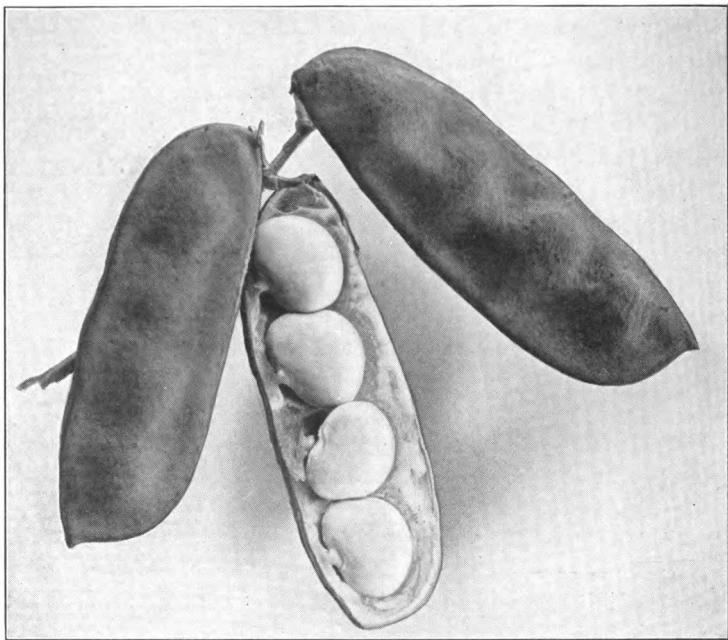


FIG. 24

**77.** The **Dreer Bush** lima bean is one of the three leading varieties of bush limas and has a distinctive type of its own; it is often called the *Potato Lima*, because it has very thick seeds. The plant grows to a large size, is very spreading in its growth, and produces many runners; it is the latest in bearing of the bush beans, has a long bearing period, and produces a heavy crop; it seems to be especially fitted to grow to advantage on light soil and in dry seasons. The green shell

pods are of a medium green color, are uniform in size, smooth, very thick, and average a little less than 3 inches in length. This variety is especially recommended for its high quality and productiveness. Specimens of Dreer's bush lima beans are shown in Fig. 24. These pods are from  $4\frac{1}{4}$  to  $4\frac{1}{2}$  inches long.

**78. The Burpee Bush lima** bean is as extensively grown as any variety of bush lima. The plant grows to a large size and is somewhat spreading; it bears its crop somewhat earlier than Dreer's Bush lima, the bearing period is long, and the crop is heavy. The shell pods are of a dark-green color, with a smooth surface, flat, uniform in size, very large for a bush variety, averaging over 4 inches, and generally contain from three to four seeds to the pod; the quality of the beans is excellent.

**79. Pole Lima Beans.**—The pole lima beans are the most popular varieties for the commercial vegetable grower where the season is long enough to render it probable that the vines will yield a full crop.

The leading varieties of pole lima beans are the *Henderson Ideal*, the *Wood Improved Pole Lima*, the *Dreer Pole Lima*, and the *Leviathan*. None of these except Dreer's Pole Lima are widely known or grown, but these less well-known varieties possess qualities which merit their more extensive culture.

**80. The Henderson Ideal** pole lima bean has been described by some authorities as being superior to any other sort because it has the unique combination of a large, straight, handsome pod, large seed, and great productiveness. This variety was not introduced until 1906, which will, to a considerable extent, account for the fact that it is not more widely grown. The vine is a very vigorous grower, matures its crop late in the season, and is very productive. The shell pods are dark green in color, straight, flat, of uniform size, large, averaging about  $5\frac{1}{2}$  inches in length, and contain five or six seeds; the quality of the beans is excellent. This variety is recommended as the best variety for the main crop.

81. The **Wood Improved Pole Lima** bean is one of the best of the small-seeded pole varieties. The vine is a vigorous grower, branches freely, bears early, and is heavily productive.

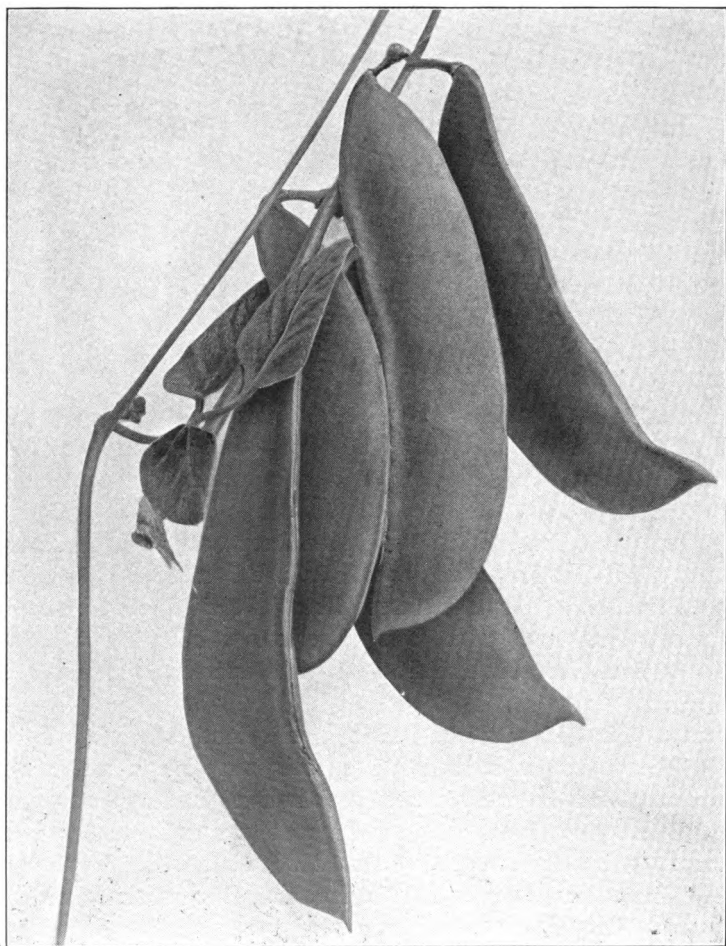


FIG. 25

The pods are a dark-green, smooth, straight, flat, of uniform size, and very small for the pole kinds, averaging 3 to 4 inches long; the quality of the beans is fair to good.

82. The **Dreer Pole Lima** bean, shown in Fig. 25, is the only variety of pole limas that is extensively grown. Like the Dreer's Bush Lima, this variety is potato-seeded, that is, the seeds are very thick, and it is the only variety of the kind in the pole class. This variety is also one of the most certain croppers and one of the most productive varieties of the lima class. The vine is a vigorous grower, the crop is borne very late, and the crop is very heavy and borne over a considerable length of time. The pods are uniform in shape and size, averaging between 3 and 4 inches in length, and have four to five seeds crowded closely into the pod.

83. The **Leviathan** pole lima bean, introduced in 1900 and the earliest of the large seeded sorts, is a splendid variety for the home garden and for market. The vine grows to a large size, bears its crop early, and produces heavily. The pods are straight, flat, uniform in size, large, averaging from 5 to 6 inches long, and contain from four to six seeds to the pod.

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#### CULTURE

84. The lima bean is of a different botanical species than the kidney bean, and it is also radically different in the appearance of the pod and the rapidity of growth of the plant. The lima bean is more extensively cultivated in the United States than in any other country.

The bean itself is one of the most nutritious of garden products and considerably exceeds the kidney bean in this respect. The lima bean is found on sale in most markets, sometimes in the green pod, and sometimes shelled and sold by the quart in berry baskets.

The seeds and plants of all varieties of lima beans are very tender. If the seed are planted before the soil is thoroughly warmed up or if a spell of cold weather occurs while they are in the ground, the greater part of the seed will most likely rot, and very few of the seedlings will come up. The plants also are very susceptible to injury from frosts, and cool, sultry weather will greatly check their growth. The soil can hardly be too

rich or too warm for lima beans. The best soil is a light, warm, well-aerated loam that is plentifully supplied with plant-food and humus.

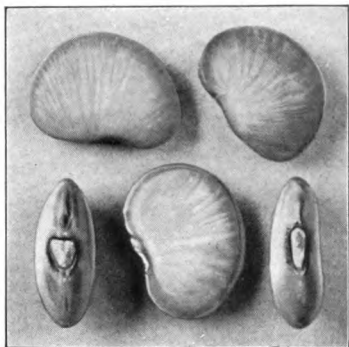


FIG. 26

85. The best time for planting lima beans, in the latitude of New York City, is between May 20 and June 10. About 2 bushels of bush lima-bean seed will be required for planting 1 acre, and about 1 bushel of pole lima-bean seed. A sample of bush lima-bean seed is shown in Fig. 26. The lima-bean seedlings make a growth similar to that of the

snap-bean seedlings. Lima-bean seedlings, actual size, with the cotyledons attached, are shown in Fig. 27.

86. The planting distances for both the bush and the pole varieties are similar to those of the kidney bush and pole beans. The bush varieties should be planted in rows from 24 to 30 or 36 inches apart and should be spaced from 3 to 4 inches apart in the rows. The pole varieties can be planted either in hills or in drills. In hills, the vines should be spaced  $2\frac{1}{2}$  feet by 4 feet, or, as sometimes recommended, 3 feet by 3 feet or 4 feet by 4 feet. The poles should



FIG. 27

extend from 7 to 8 feet above ground, and from six to seven seed should be planted in a hill and later, after they are large enough to allow of selection, they should be thinned to the best three or four plants of the lot. Pole lima vines are

shown in Fig. 28. When planted in drills, the plants are trained on a trellis like that shown in Fig. 16.



FIG. 28

**87.** In order to secure an early crop, lima beans are sometimes started in a hotbed. Seldom, however, will the extra expense be justified. The seed is sown in flats, pots, etc. filled with rich soil, and the plants transplanted at about the time

seed is sown in the field. The plants are set with the ball of earth in which they grew and the roots are injured very little. The seed should be sown under glass about 4 weeks before the plants are to be set outdoors. From such plants a crop should be matured about 2 weeks in advance of that from outdoor-sown seed.

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### MARKETING

88. The prices of lima beans are subject to wide fluctuations, due largely to the variation in supply. In cold weather, lima beans are considered a luxury and bring proportionately high prices, but even during the summer and fall months when they are in largest supply, they usually bring fair prices. Because of failure of the crop in different sections at various seasons, lima beans are not always in the market, although of late years the supply is more continuous than formerly.

In the New York markets, lima beans are now mostly sold by the bushel basket, like string, or snap, beans, although they are sold by the crate, bag, box, and case at certain seasons. In some markets, they are sold in  $\frac{1}{2}$ -bushel and  $\frac{3}{8}$ -bushel baskets.

During the winter months, lima beans are sold in the New York markets largely by the crate, box, and case; these lima beans come principally from the South. At this time the prices range from about \$2 to \$5 a crate, from \$2 to \$8.50 a bushel basket, from \$2.25 to \$6 a box, and from \$6 to \$7 a crate. The capacity of these packages is somewhat indefinite, but they usually contain about 1 bushel. During the warmer months, the prices for lima beans vary from about 25 cents to as high as \$2.50 a bushel basket, and from 50 cents to \$3 a bag.

The high prices for lima beans begin with December and continue throughout the winter and spring and through July. Good but somewhat lower prices are also received in August. The months of the lowest prices are September and October. During November, the prices again show an improvement.

# GARDEN PEAS

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## GENERAL REMARKS

1. The term **garden peas** or **green peas** is applied to the peas that are eaten in a fresh, or green, state. **Field peas**, although similar to garden peas in many respects, are eaten only when dried, and as a commercial product are distinct from garden peas. Garden peas are grown on market gardens, on truck farms, and in home gardens all over the country. They are extensively grown for the canneries as well as for sale green.

2. The pea is a hardy annual legume adapted for culture in all parts of the United States. It has been cultivated from earliest known times, long before the beginning of the Christian era. It is a native of the southern part of Asia and was early introduced into the southern part of Europe, from whence it has been distributed westward over the rest of the world.

The pea is normally a climbing plant, although there are now dwarf varieties that do not need supports. The seeds are produced in pods, which are frequently borne in pairs. The field pea differs but little from the garden pea except in that the flowers are violet instead of white, and that the seeds are small instead of fairly large like most varieties of garden peas, and are gray instead of green. The garden pea is usually raised for the seed, although there are a few comparatively unimportant kinds with thick pods, which are eaten with the seeds, the same as green snap beans.

3. The garden-pea crop is one of the coarser vegetable crops, and there are several advantages and disadvantages con-

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nected with its commercial production. The chief advantages are: (1) The peas are ready for market early and will bring quick returns early in the season, when there is a scarcity of marketable crops; this is particularly important for the truck farmer, who ordinarily secures his first crop much later than the market gardener; (2) they will do better on soils of only fair fertility than most other garden vegetables; (3) they are hardy and may be planted early in the spring, pea seed frequently being the first seed put in the ground; (4) there is a good demand for this crop, in spite of the fact that the city dweller usually gets his peas so long after they are picked that he rarely has the privilege of eating a dish of strictly first-class peas.

The chief disadvantage connected with the commercial production of garden peas is that they do not yield much of a profit on expensive land nor in localities where there is not an abundant supply of labor. Peas are light yielders, and, unless exceptionally high prices are obtained for them early in the season, the gross returns are comparatively small. The cost of the culture is not large, but the cost of harvesting and marketing is high and the risk is considerable.

Garden peas are rarely grown by market gardeners who are located on very high-priced land near the large cities, because the net returns are usually insufficient. They are usually grown only on comparatively cheap land.

4. Garden peas are extensively grown in the South so as to reach the Northern markets during March, April, May, and June, before the local Northern producers can supply the trade. In the far Northern States, garden peas are grown in greatest quantities in time to supply the demand during July and August, when the weather in the vicinity of the big markets is too hot to allow of a good growth of pea vines.

5. **Commercial Importance.**—The garden-pea, or green-pea, crop is about as valuable in the United States as the green-bean crop. According to the census of 1910, the total value of the green-pea crop in 1909 was \$2,785,502, produced on 70,487 acres, distributed among 17,219 farms; this shows an

average of about 4.1 acres per farm, or considerably more than the average of about 2.48 acres per farm for green beans.

Green peas are extensively grown, being raised commercially in almost every state in the country. The eleven principal states, ranking in the order of the value of the crop produced, are: New York, Wisconsin, California, Maryland, New Jersey, Indiana, Michigan, Virginia, Ohio, Illinois, and Massachusetts. The first ten of these states produced more than 80 per cent. of the total crop, and New York alone produced more than 33 per cent.

The average income per acre for the country is about \$39; in New York, about \$47; and in other states it goes up above \$90. Skilful growers, who obtain high prices for their peas, however, secure much larger returns.

The pea-packing industry has grown to large proportions. The following is the number of cases of 2 dozen cans each packed in the United States for the years indicated: 1908, 5,577,000; 1909, 5,028,000; 1910, 4,347,000; 1911, 4,532,000; 1912, 7,307,000.

**6. Cost of Production and Income.**—There is a wide variation in the cost of production of peas, depending on whether the crop is grown for market, for the cannery, or for seed. When the crop is grown for market, the cost of fertilization, cultivation, picking, and marketing is higher than in the other cases. The cost of picking is by far the largest item. Frequently, as much as 35 cents a bushel must be paid for picking the smaller varieties of peas, and about 25 cents a bushel for the larger varieties; this item in itself will amount to an average of one-fourth to one-third of the gross receipts. The peas for canning and those for seed are commonly harvested by machinery, and, in some cases, shelled by machinery, at a very low cost. For the commercial vegetable grower, the total cost of production and marketing per acre for garden peas will range from \$50 to \$100.

A full yield of garden peas is estimated to be from 100 to 150 bushels per acre. A net return of from \$50 to \$100 per acre is usually considered satisfactory from such a crop.

**7. Climatic Requirements.**—In considering whether or not the climatic conditions of a locality are suitable for peas, the temperature, moisture supply, and the liability of late frosts must be taken into account. The pea is essentially a cool-weather plant and does not do its best in warm weather; in hot, dry weather the growth is weak, and diseases are damaging. Commercial plantings are, therefore, made so that the crop can be matured before hot weather sets in; this means that the planting is done early in the spring. The best conditions for the growth of the pea are found in the North, but similar conditions can also be found in the South if the peas are grown during the cooler months of the year; most of the peas in the South are grown in the trucking sections for shipment North early enough to beat the crop from the Northern fields into the market.

An ample water supply is essential to a large yield, because, unless plenty of water is present, the growth will not be rapid and continuous.

Peas are damaged less by a frost than many other vegetables, and will even stand some hard freezing. Considerable damage may be done, however, if the plants are suddenly frozen when the growth is soft, as it will be when the plants are growing rather rapidly.

**8. Soils.**—Light, sandy loam soils are best for peas, although the crop can be raised successfully on many other soils also, if they are loose and well drained. Many heavy soils that are well drained may be fitted for the growth of peas by heavy manuring or by plowing under green-manure crops for the purpose of incorporating large quantities of humus in the soil. Crops of field peas are frequently raised on the heavier soils, such as the clay loams.

## VARIETIES, SEED, AND SEED PRODUCTION

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### VARIETIES

9. Peas vary widely under different soil and climatic conditions; in fact, somewhat more so than most vegetables. The consequence of this variation is a large number of varieties and a variation between plants of a variety grown in different localities. Only a comparatively few of the varieties, however, are of commercial importance.

Probably the most satisfactory way to group varieties of peas for the commercial vegetable grower is according to the date of their maturity, as *early*, *midseason*, and *late* varieties. Other useful classifications are based on the character of the seed, that is, whether it is smooth or wrinkled; and still others on the size of the growth of the vine, that is, as dwarf, semi-dwarf, medium, and tall.

10. **Early Varieties.**—The most hardy peas of the earliest varieties are those that are smooth. The seed of smooth peas may be sown just as soon as the frost is out of the ground in the spring, and, unless conditions are particularly unfavorable, germination will be good. The vines of these early peas grow only to small size, but produce pods very early; the pods are small, but in the better varieties are usually well filled; some varieties yield very abundantly in proportion to the size of the plant. Peas of this kind lack the sweetness and quality of the wrinkled sorts, and are planted only to supply the first demand of the early market.

11. Two of the popular market varieties of early peas are the **Alaska**, shown in Fig. 1, and a variety variously named **First Early**, *First and Best*, *Extra Early*, and by other equally

indefinite names. The vines of these two varieties grow to a height of 2 feet or less, and bear from four to seven pods to a vine. The pods are about 2 inches long and contain from four to seven peas to a pod. The expense of harvesting these varieties of small peas is considerably more than that for the later, larger peas. Early in the season, however, they usually bring good prices, but as soon as the larger, wrinkled peas come into the market, the small, smooth peas are almost entirely displaced.

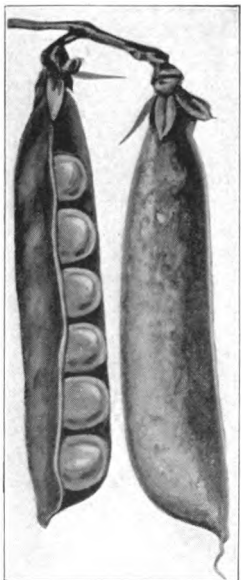


FIG. 1

**12. Midseason Varieties.**—The midseason, or second early, varieties of garden peas are numerous. They are wrinkled peas and are of good quality, but when planted too early are likely to decay in the ground. The bearing age of the midseason varieties varies over a wide range of territory, but they are never first earlies nor very late. The vines grow from 1 to 3 feet in length, and both the size of the pod and the yield vary considerably with the different varieties. The peas of this class are commonly planted a few days later than the round-seeded first early varieties, in order to give a succession of pods for market. Some of the leading midseason varieties are the *American Wonder*, *Nott's Excelsior*, *Sutton's Excelsior*, *Gradus*, and *Thomas Laxton*.

In addition to these leading varieties, there are many other midseason varieties, and all differ somewhat in the size of the vine, in the shade of color, in the size, in the shape of the pod, and in the yield. There are also various strains of the leading varieties. The best practice is to select a variety of proven worth for the main part of a crop and to grow other less well-known varieties only experimentally.

**13.** The *American Wonder* pea is the most dwarfish variety of the midseason varieties and is of more value for the

home garden than for the market grower. The plant will grow to an average height of about 1 foot, and each vine will produce from three to seven pods; the crop matures in from 60 to 70 days. This variety does well when planted as a companion crop.

**14. Nott's Excelsior** peas, illustrated in Fig. 2, and **Sutton's Excelsior** peas are very similar in habit of growth. The latter produces a somewhat larger pod than the former, and the pods will probably average one more pea to the pod. Both of these are excellent early varieties for the commercial grower. The crop of both varieties is matured in from 65 to 70 days, the yield is as heavy as that of any of the midseason varieties, and the peas are of excellent quality. The vines do not need support.

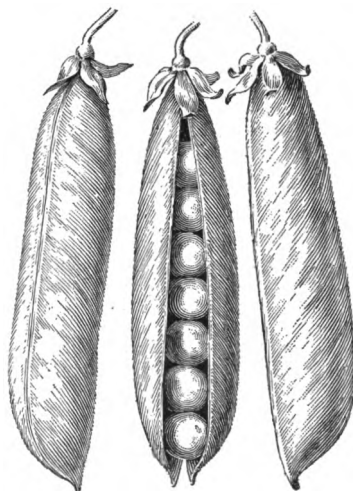


FIG. 2

**15. The Gradus** pea, illustrated in Fig. 3, is one of the largest of the midseason varieties. The vines grow to a length of 3 feet, and the crop can be handled to best advantage when the vines are *bushed*, that is, when they are grown as bushes on brush. The rows should be planted from 3 to 3½ feet apart. The Gradus excels in quality, and, when the ground is not overstocked with nitrogen, and phosphoric acid and potash are present in sufficient quantities, the yield is good. The pods are of medium large size, and when well filled contain from six to nine large peas. This variety requires from 7 to 10 days longer to reach maturity than Nott's Excelsior or Sutton's Excelsior, but a good strain of Gradus is considered to be one of the most valuable of the standard sorts of garden peas for the main crop.

**16.** The **Thomas Laxton** pea, shown in Fig. 4, is another of the large-podded, high-quality peas of the midseason varieties. It is very similar to the *Gradus* in the size of the vine and the pod and in earliness and rapidity of growth; the pod

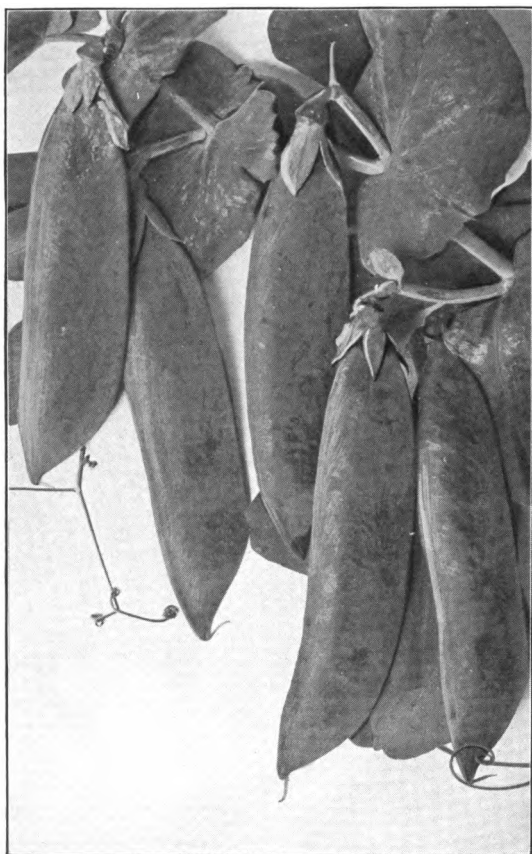


FIG. 3

is a trifle shorter and a little deeper green in color than the pods of the *Gradus*. This pea yields fully as heavily as the *Gradus* and sometimes exceeds it. The variety grows to greatest perfection when bushed, although it can also be grown without support with fair success.

**17. Late Varieties.**—There are about as many of the large-growing late, or summer varieties as of the midseason varieties. Only a limited number are grown commercially,

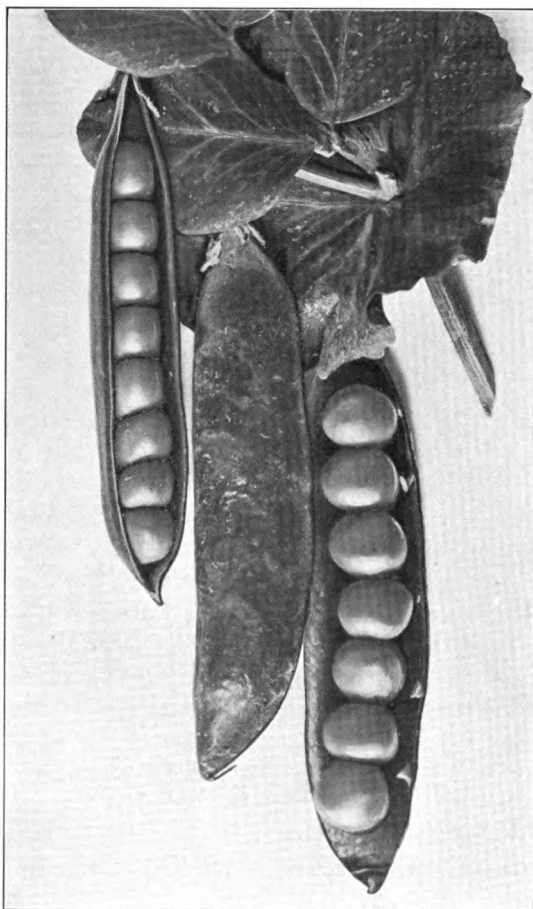


FIG. 4

however; the best of these are the *Telephone* and the *Champion of England*.

**18.** The **Telephone** pea, illustrated in Fig. 5, and the **Champion of England** pea have vines that grow to a height

of 3 to 5 feet; they grow vigorously and bear large, handsome pods, which contain from six to ten peas each. The quality

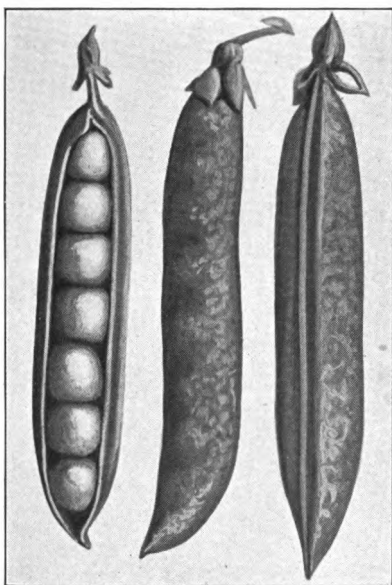


FIG. 5

is unsurpassed. To permit of proper development, the vines need support. Both of these varieties are highly prized as the best of the late varieties, and they are so similar in habit of growth, in the character of the vine, and in other characteristics that no separate description is needed.

These late varieties should not be planted until the weather has become fairly well settled in the spring. They will do well planted in double rows with supports between the rows. If the land is rich and the proper support is

provided, the vines will often grow to a height of 6 feet. When the vines are bushed, the pods are easy to pick, and proper fertilization assures a large crop.

#### SEED AND SEED PRODUCTION

**19.** The bulk of the pea seed used in the United States is grown in the northern tier of states bordering on the Great Lakes, notably in the northern parts of Michigan, Wisconsin, and New York, and in some of the adjacent parts of Canada; seed from this section is less likely to be infected with insect pests, like the pea weevil, than that grown farther south. Much of the high-grade pea seed used in the United States, however, is imported from England, where peas grow to their greatest perfection.

The home production of pea seed is perfectly feasible, but is usually considered to be rather expensive. Peas do not multiply as many fold as most other vegetables, often not more than five fold, and seldom as much as twenty fold. On a small scale, more labor is also usually required for the work of harvesting and drying than the results usually warrant.

20. Commercial pea seed growers commonly have on hand two kinds of pea seed: (1) *Selected seed*, and (2) *stock seed*. The selected seed is that which is taken from promising individual plants. Because of the small yield of pea seed, commercial seed growers are not able to offer the seed from specially selected plants, as in the case of the tomato, squash, cucumber, etc., except at such high prices as to place it beyond the reach of commercial vegetable growers. Only other seed growers can afford to buy it for seed-producing purposes. This selected seed is planted only by seed growers for the production of stock seed, which is offered to the public.

The stock seed is not sorted or selected on any basis of the quality of the individual plants from which it comes. It consists merely of all the product of the vines grown from the selected seed, with possibly only the small or obviously imperfect or split seed picked out. Much of the pea seed offered for sale to the public is not even grown from selected seed, or at least from well-selected seed.

The production of pea seed is attended with many difficulties, because peas are very variable and unless carefully selected the varieties soon lose their distinctive characteristics; to complicate matters, variations are also caused by soil and other local conditions. Because of this variable nature of the pea plant, many of the so-called varieties are simply more or less desirable strains of some leading variety. The most that any seedsman can do in the growing of pea seed is to make every effort to keep his varieties fairly pure and of high quality by frequently, if not annually, renewing his selected seed by careful selection. The planter is more dependent on the integrity and skill of the seed grower for the quality of his pea seed than for the quality of almost any of the other common garden seeds.

**21.** The production of large quantities of stock seed in the field is simple. The ground should be plowed and cultivated in the fall so that a disking and one or two harrowings in the spring will put it in good condition. The seed should be sown very early. Some growers broadcast the seed, but sowing it in drills will usually be found more satisfactory. The seed may be sown by hand or by a seed drill; the seed drill used should not crack the seed; some seed drills will crack the seed badly, and many poor stands have been due to this trouble. The distances for planting in drills and the general culture are the same as for the regular crop. The vines should be encouraged

to make a good growth, and the ground should be kept free from weeds.

The vines should be harvested before they have matured so far that there will be danger of the seed shelling out of the pods during handling. The common pea harvesters, which are attachments to mowing machines, may be used, or the vines may be cut with a scythe. They should be placed in windrows to dry



FIG. 6

out some, stacked, preferably under cover, and then threshed. A fair crop of pea seed is about 1,000 pounds to the acre; a heavy crop is about 3,000 pounds.

**22.** Pea seed is comparatively large for vegetable seed; from 50 to 150 garden peas are required to weigh 1 ounce; field peas are somewhat smaller, from 150 to 250 being required to weigh 1 ounce; 1 quart of garden peas will weigh from 25 to 28 ounces, and 1 quart of field peas will weigh from 21 to 28 ounces. A sample of pea seed of average quality is shown natural size in Fig. 6.

Pea seed is comparatively long lived, retaining its power of germination about as long as bean seed. The average length

of time pea seed will retain its power of germination is about 3 years, the extreme limit being 8 years; fresh seed, that is, seed 1 year old, is, however, usually considered preferable. To be considered high grade, pea seed should be 99 per cent. pure, and about 98 per cent. of the seed should germinate. Under favorable conditions, the seed will germinate in from 6 to 12 days, or a little less quickly than bean seed. Pea seedlings are shown natural size in Fig. 7.

At the usual distances for planting peas in drills, from  $1\frac{1}{2}$  to 2 bushels of garden peas will be required for sowing 1 acre, and

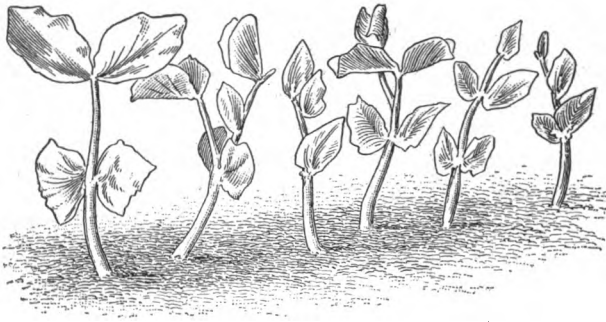


FIG. 7

about 1 quart will be required for sowing about 100 feet of drill. High-grade garden pea seed retails from seed dealers at from 25 to 55 cents a quart, and from \$5 to \$10 and \$11 a bushel; larger quantities, however, can be purchased somewhat cheaper.

Only the best quality of pea seed should be used in commercial plantings, because poor seed will produce plants that will run largely to vines and that will produce few good pods.

## PLANTING AND GENERAL CULTURE

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### PLANTING

**23.** For peas, the soil should be plowed from 5 to 6 inches deep and should be thoroughly harrowed. Peas do not, however, require the painstaking surface fitting of the soil that is necessary for many of the small crops, such as beets, carrots, celery, lettuce, etc.

**24.** The time for planting peas depends somewhat on whether the seed is being sown for the early or the late crop, on the latitude, and on the variety. The seed for the early crop is usually planted as early in the spring as the ground can be prepared. In the latitude of New York City this will be sometime in March; in the South peas are planted in successive crops from about the first part of December until April, and are also planted in August and September; in the New England States early peas are planted from the middle to the latter part of April or until about May 1, and in the Middle West they are planted about the middle of April. In the Northwest, peas are planted in February and March and in Southern California they are planted in December, January, and February for sale during the winter and earliest spring months.

The wrinkled varieties should usually be planted somewhat later than the earlier smooth varieties, but some growers take the chance of injury by frost and plant them at the same time. In the latitude of New York City the seed for the fall crop is planted during the first part of August.

**25.** To secure the quickest germination of the seed and the best growth of vine, pea seed is planted at different depths, according to the time of year and the varying conditions in different localities and soil. The quickness of germination

depends on the moisture and heat to which the seed is subjected, and as the pea does best under cool conditions, the depth of the roots in the soil is important; the depth of the roots also has considerable to do with the quantity of moisture they can secure. The depth of planting the seed will depend (1) on the quantity of moisture present in the soil, which will vary with the character of the soil and the season of the year; and (2) on the temperature, both in the soil and in the air, which will vary with the moisture present and the season.

Early in the season, when there is ample water in the soil and the temperature is low, the seed may be safely planted about 1 inch deep; in light soils, however, a covering of about 2 inches would probably be better. The plantings should be made deeper and deeper as the season progresses, until about 4 inches is reached, although in the late part of the summer, the seed is sometimes planted from 5 to 6 inches deep; when planted as deeply as this, however, it should be planted 1 to 2 inches deep in shallow furrows 3 to 4 inches deep, and the soil should be gradually thrown in after the plants are up.

**26.** The distances at which peas should be planted depend on the variety, that is, on the height to which the vines grow, on the fertility of the soil, and on the purpose for which the crop is intended. Most market growers space the rows about  $2\frac{1}{2}$  to 4 feet apart and sow the seed rather thickly. Many growers sow the seed by hand, dropping it in a shallow furrow, and covering it later with a hoe; the thickness of sowing should be determined by the viability of the seed; as previously mentioned, 1 quart of seed should be ample to sow about 100 feet of drill; many growers estimate that the seed should be sown at the rate of from ten to twenty to the foot. In order to secure plenty of loose soil about the freshly planted seed, many growers claim that the seed should be sown in a furrow 2 to 3 inches wide and of a depth varying according to the conditions previously described.

The ordinary small garden seed drill can seldom be made to sow sufficient pea seed, plow deeply enough, allow the seed to spread sufficiently, or cover the seed with enough soil. One

grower makes shallow furrows with a light plow, sows the pea seed with a seed drill with the plow and covering wheel held off the ground, and then covers the seed with a hoe or a scraper. When properly adjusted the one- and two-horse corn planters will plant peas to good advantage.

27. Peas intended for the canning factory are frequently sown with a grain drill, and the crop is harvested by mowing down the vines with a common mowing machine, raking them over with a hay rake, and then picking off the pods. Sometimes the seed is sown broadcast, harrowed in, and the vines harvested as previously described under seed production; this method of handling the crop, however, is less generally employed than formerly.

The home gardener and the small market grower will sometimes plant peas in double rows about 6 to 7 inches apart and furnish a support for them to climb on. This is practiced with some of the taller-growing varieties. The commercial grower very largely, if not entirely, sticks to the low-growing varieties and avoids the necessity for supports.

28. One of the best supports for the tall-growing pea vines is birch brush; some other kinds of brush are also suitable. Birch brush should be cut when the stems are about 1 inch in diameter near the base and the branches are about 5 to 6 feet long. Preferably, the brush should be cut some time before it will be needed and pressed so that the branches will all be in one plane, like a fan. This may be accomplished by laying the brush on the ground in long piles two or three deep, with the butts all one way, and weighting down the branches with logs or some other heavy material. After a few weeks of this treatment the brush will become well-flattened and will retain this shape when set between the rows of peas. The small branches should be cut back to a length of about 12 to 18 inches. If the peas are planted in double rows, the flattened brush is set firmly in the ground half way between the rows and with the flat side to the rows; this is usually done just after the pea seedlings have broken ground. If the peas are planted in single rows, the brush is set in the ground along one side.

Poultry netting stretched on stakes between the rows may be used to support pea vines, but this is rather expensive, and, because of the difficulty of placing and removing it, is usually considered less satisfactory than the brush.

Another support for pea vines may be constructed by setting two strong posts on each side of the ends of each row. Lighter stakes, such as plastering laths, are then set in the ground along the rows at intervals of about 10 feet; these are also set in pairs, one on each side of the row, and are bent over and tied at the top with stout twine. Strings spaced about 5 or 6 inches apart are then stretched from the end posts along the laths on each side of the row in order to give enough support to the vines. A support of this kind is suitable for the home gardener but it is too expensive in labor cost for the commercial grower.

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### CULTIVATION AND FERTILIZATION

**29. Cultivation.**—The cultivation of peas should start as soon as the seedlings have broken through the ground, which will normally be in from 6 to 12 days after planting. The cultivation should be shallow and frequent; deep tillage will do more harm than good. Usually one or two hand hoeings will be necessary to keep down the weeds close to the plants and between the plants in the row.

If the peas have been planted in a shallow furrow, the soil should be gradually thrown into the furrow during cultivation, at least until the surface is level with the ground. Usually it will also pay to ridge the rows slightly. This will cause the plant roots to be several inches under ground in cool, moist soil, where the conditions are most congenial.

**30. Fertilization.**—The work of fertilizing peas and maintaining the organic matter, or humus, in the soil, is closely associated. The pea grows best in soils rich in humus, but the soil should not contain too much soluble nitrogen along with this. An oversupply of nitrogen, such as may be put in a soil by the application of coarse, fresh manure or highly nitrogenous commercial fertilizer immediately before the peas are

planted, will cause a too rank growth of vines. Vines growing too rankly will bear few pods, the peas will be of inferior flavor, and the maturity of the crop will be delayed.

The best method of applying fresh stable manure to soil intended for peas is to apply it the previous year to some other crop; fresh stable manure should never be applied a short time before peas are planted. Well-rotted stable manure may, however, be safely applied at this time, but only market gardeners will have this material available.

The use of manure on land intended for peas is not essential; the necessary organic matter can be supplied by means of green-manure crops; this fact makes it possible for a large number of truckers to produce the crop. A clover sod is perhaps the best to turn under immediately before peas are planted, but Crimson clover, soybeans, and cowpeas may also be used to good advantage. Non-leguminous crops, like rye, are also good, although they supply no nitrogen. The pea vines themselves, after the crop is harvested, should be turned under. When the crop is raised for the cannery, the vines should be hauled back to the field, spread over the ground, and plowed under.

**31.** Peas respond profitably and quickly to the application of commercial fertilizers, and the larger part of the pea crop is grown without the application of other plant-food. The main part of a fertilizer for peas should consist of phosphoric acid and potash so that a strong, stocky growth of vine will be encouraged and an excessive production of seed induced. A certain quantity of nitrogen is also essential, in order to get growth started quickly and induce an early yield. A small quantity of nitrogen is particularly effective on the first plantings in the spring. Although the pea is a legume and gathers nitrogen for itself from the air, the seedlings of the earliest spring plantings begin growth before nitrification in the soil becomes active, and hence a small quantity of some quick-acting nitrogenous fertilizer, such as nitrate of soda, is an important help. In fact, a small percentage of nitrogen will usually be found profitable for all plantings; the danger from nitrogen comes only when it is overdone.

32. If peas are to be grown on a light loam soil that has been heavily manured in previous seasons, a commercial fertilizer analyzing about 3 per cent. of nitrogen and 10 per cent. each of available phosphoric acid and potash should give excellent results. The quantity to apply will vary with the fertility of the soil and the prices the grower expects to receive for the crop. Market gardeners who can get good prices for their produce commonly apply about 1,000 pounds of such a fertilizer, broadcasting and harrowing in about 600 pounds during the preparatory tillage, and scattering about 400 pounds in the furrow just before the seed is planted; this should, however, be worked into the soil so that the seed will not come into direct contact with it; some seed drills will apply the fertilizer, work it into the soil, and plant the seed at the same time. Truck farmers who must ship their peas long distances and who do not expect as large gross returns seldom apply more than 500 pounds of commercial fertilizer.

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## INSECT PESTS AND INJURIES

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### INSECT PESTS

33. The insect pests that attack peas are few in number, but some are rather troublesome. The most important are the *pea aphids*, the *pea weevil*, and the *cutworms*.

34. The *pea aphids* is sometimes a very serious pest on late, or summer, peas, although it is noticeably destructive only occasionally and is not nearly so abundant as it was 12 to 15 years ago. The aphids are like large green plant lice crawling along the stems and over the foliage. Two forms appear together throughout the season—the winged shown in Fig. 8 (a), and the wingless, shown in (b); the former become more plentiful as the food supply becomes more scarce. The bodies of the winged aphids are about  $\frac{1}{8}$  inch or a little more in length, and the wings span about  $\frac{2}{5}$  inch. The wingless ones are somewhat similar in length, but are considerably broader. The insect injures the plant by sucking out the juice and thus

causing it to wilt and, if the insects are plentiful enough, to die. In addition to peas, these insects feed on clovers, vetches, and similar plants, so that the absence of peas for a time will not necessarily starve them out, if other food plants are present. The aphids usually attack peas when they are about 6 to 8 inches high, feeding on the plants and giving birth to live young; the reproduction is rapid, as many as sixteen generations having been observed in a little more than 6 months.

The pea aphid has many destructive natural enemies, including a number of the more common ladybird beetles, syrphus flies, and lace-winged flies. The insect is also seriously attacked by a fungous disease that, like other diseases of a similar nature

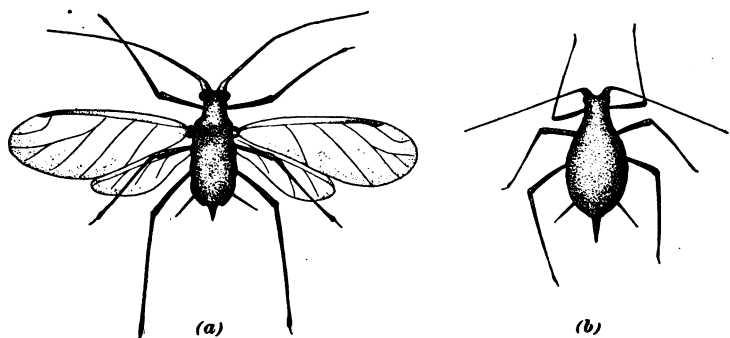


FIG. 8

develops best in damp weather. Some of the most serious outbreaks of the pea aphid have been due to the occurrence of two dry springs in succession; in such weather the fungus made little development and the insects were unchecked.

35. Both general and specific methods of control may be required. Crops like peas and clover should not be planted too near together, because pea aphids travel from one to the other. If they are noticed in large numbers on clover the only sure way of preventing them from getting on the peas is to plow the clover under deeply. Whether or not this would be economical must be decided by circumstances. High fertilization will assist the pea vines to withstand the ill effects of an attack of aphids. As the early varieties are seldom

attacked by the insect, damage may be largely avoided by planting only such varieties. This is the most practical way out of the difficulty.

For control by spraying, a contact insecticide must be used, because the pea aphid is a sucking insect. As the aphids usually concentrate their attack on the new growth at the ends of the vine, the spray mixture must be applied under considerable pressure, so that the upper parts will be well covered. Whale-oil soap (1 pound of whale-oil soap to 6 gallons of water), tobacco dust, or one of the tobacco solutions are probably the best insecticides to use; kerosene-oil emulsion is effective in killing the insects, but, unless carefully made, it often causes some injury to the vines.

**36.** The pea weevil is a very common insect and occurs in all parts of the world where peas are grown; the adult form is shown enlarged in Fig. 9 (a), and the larva in (b). As this insect does its work in the pods of late and field peas and in the pea seed held in storage and rarely affects the pea crop that is grown for sale green, it is of minor importance to the commercial vegetable grower. In the colder climates it does comparatively little damage, and for this reason many seed dealers buy their seed peas from growers in Canada, and in the northern parts of Michigan and Wisconsin.

**37.** About the only place that the commercial vegetable grower has to contend with the pea weevil is in pea seed. Probably the most sure method of killing the weevils in seed peas is by fumigating them with carbon bisulphide. This can be done in almost any air-tight receptacle; on a small scale, a coal-oil barrel is suitable, provided a tight cover is placed over the top; such a barrel will hold about 300 pounds of pea seed, or about 5 bushels. About 1 ounce of carbon bisulphide should

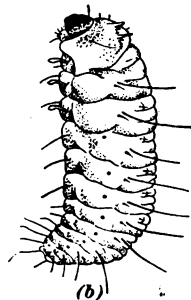


FIG. 9

be used for every 100 pounds of seed. The seed should be placed in the barrel, and the carbon bisulphide either poured over the top, or placed in a pan on top of the seed and the cover placed tightly on the barrel; the gas that comes from the liquid is heavier than air and will settle through the seed. The seed should be allowed to remain in the atmosphere of carbon bisulphide gas for about 24 hours, which should insure the killing of all insects. No flame should ever be brought near carbon bisulphide, as the gas is very inflammable; neither should the gas be inhaled, for, although it is not poisonous, it has a suffocating effect.

**38. Cutworms**, although not a special enemy of the pea, will attack pea vines as they will many other plants. They will feed largely on the new stems and, when plentiful, may cut down enough vines to do serious damage; this, however, seldom occurs.

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### FUNGOUS DISEASES

**39.** Fungous diseases do not seriously injure peas, and outside of practicing a rotation that will avoid loss from this source, commercial vegetable growers pay little attention to them. *Pea spot*, *pea powdery mildew*, and *pea rust* are the diseases most commonly found.

**40.** *Pea spot* attacks both the pods and the leaves, on which it makes circular, slightly sunken, dark-bordered spots with pale centers. Spots on pea leaves are shown in Fig. 10 (a), and spots on a pea pod are shown in (b). The lower, and older, leaves are attacked first, then the younger leaves, and later the pods; the disease also attacks the stems of the plant, and is most serious in this form, because an injury to a stem affects a considerable part of the plant. The disease on the pods may completely penetrate them and attack the seed; diseased seed may show the characteristic spots, but in some cases the disfigurement is so slight as to be barely noticeable.

The principal method of control is to practice a good rotation; usually 2 years should intervene between peas, or other crops

that will be affected by the disease, on the same soil. Seed suspected of being diseased may be disinfected by immersion in a formalin solution (1 pint of formalin to 30 gallons of water).

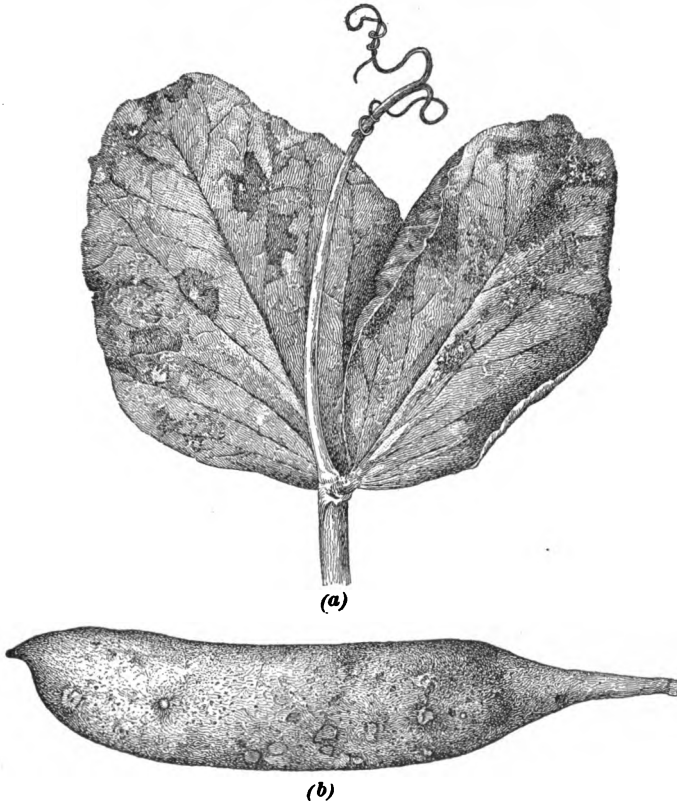


FIG. 10

Because of the injury to the vitality of the seed, however, the use of diseased seed is never advisable.

**41.** The **pea powdery mildew** is similar to the disease that attacks a great many plants and is particularly troublesome on grapes. The parts of the plant attacked become covered with a whitish, powdery coating. The most serious attacks occur during unfavorable weather late in the season, and, in some cases, plants so attacked do not mature seed.

Seldom, however, is the damage caused by the disease considered serious, although in some cases it has caused the loss of about one-third of a crop. The most common method of infection is from seed grown in infected pods.

42. The most effective means of avoiding loss from powdery mildew is to plant only uninfected seed. Good cultivation and liberal fertilization also assist, because plants that are growing vigorously will be less seriously affected than those that are making a weak growth. Spraying with Bordeaux mixture (5 pounds of copper sulphate, 5 pounds of stone lime, water slaked, and 50 gallons of water) will check the spread of the disease, if it can be thoroughly applied, but as the waxy coating of the pea vine readily sheds moisture, it is difficult to get the spray mixture to adhere well. Spraying is seldom practiced.

43. **Pea rust** is similar to the rust that attacks beans. It appears only infrequently and the damage it does is of little consequence.

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## HARVESTING AND MARKETING

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### HARVESTING

44. In order to secure peas at the height of their quality they must be picked at the right time. They should be harvested before they begin to harden, but if they are harvested too soon the profits will be diminished. Pods that are flat should not be picked, because the peas in such pods will not be well developed. In picking, all discolored and rough pods should be discarded, because the peas in such pods will be overripe or of poor quality and will injure the sale of the good pods in the package. The exact time for harvesting can be told only after a little experience; a good plan for deciding on the time is to test the sweetness and flavor of the peas by tasting. Normally, the peas of the early varieties will be ready for marketing in from 60 to 70 days after planting, and the later varieties will be ready for harvesting in from 1 to 4 weeks later.

45. When they are picked by hand, peas are one of the most expensive of the vegetable crops to harvest, and it is almost essential that the grower be able to command the services of several extra helpers at picking time; children can do this work fully as well as adults, although possibly not so rapidly. This work is most commonly paid for by the bushel, from 20 to 35 cents per bushel being paid, according to the variety and the size of the crop on the vines. The total expense per acre for this work can be estimated from the yields, which vary widely with varieties and cultural and soil conditions; yields as low as 60 to 70 bushels to the acre are not uncommon, although under the best of conditions more than double this yield can be secured; it can be readily seen that the cost of harvesting is the principal item in the cost of production.

When the pods are picked for market, from two to three pickings should be sufficient to gather all of the crop. Immediately after picking, the vines should be plowed under and the land devoted to some other crop.

46. Garden peas in the pod are usually packed in 1-bushel baskets or hampers, although sometimes they are packed in  $\frac{1}{2}$ -bushel baskets and in crates. In packing, the pods should be shaken down well in the package, so that the jarring in transit will not make them settle to such an extent that a space will be left at the top; such a space creates a bad impression when the package is opened. After shaking the pods down, a small quantity should be piled up above the edge of the basket and the lid pressed down and fastened.

Because of their soft, green condition, garden peas do not ship as well as many other vegetables, and they should be handled quickly. The packages should also be well ventilated to prevent heating up. For this reason only baskets and slatted crates are used. Green peas in the pod should never be put up in packages containing more than 1 bushel, because in larger quantities they will heat up much more quickly.

47. When sending peas to market in the pod, every effort should be made to have them arrive in a plump and attractive condition; this is especially true in a local market where each

grower's product is more or less well known. Pods that are plunged in cold water immediately after picking will stand up better and be more plump when they arrive in market than those that are picked, packed, and sent to market directly from the field. The cost of this immersion in cold water is small as compared with the effect produced.

48. The quickness with which peas are gotten to market also has an important influence on their quality when placed on the consumer's table. The garden pea, like sweet corn, loses much of its richness and quality a short time after picking, and it is practically impossible to buy peas in most markets that have a quality equal to those that are placed on the table within 5 to 6 hours after picking. For this reason, peas should be marketed quickly. The market gardener with a small local trade can, by careful attention to picking only a short time before starting out with his wagon, sell his peas to better advantage and have better satisfied customers than any other producer.

49. The harvesting and shelling of peas for the canning factory is an entirely different proposition than picking them for market, and can be much more cheaply done. For the canning factory, the vines are cut with a mowing machine, when the peas are at the proper stage of development, and are carried on wagons to a point where a machine called a *viner* is in operation. This is somewhat similar to the threshing machine used to separate the ripe, dry peas from the pods and vines. The vines and pods are subjected to the action of revolving beaters and cylinders, and the green peas are separated about as effectively as are the dry ones in the threshing machine. As soon as they are shelled, the peas are sorted by passing them over a series of screens of varying mesh. The different grades are paid for at different rates, the higher prices being paid for the smaller sizes.

In harvesting and shelling peas for canning, rapid handling is essential, because the green vines will begin to heat up and decay within a few hours after being cut. The best method of working is to cut, separate, and can the peas all in the same day.

When they are handled in this way, the quality of canned peas should be better than that of the average run of fresh peas that can be secured in the markets, because they are then canned before their richness and quality is lost.

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### MARKETING

50. As green peas are very perishable, they must be sold promptly on arrival in the market, and hence in times of oversupply the wide variations in price that occur are not unreasonable. Peas, however, meet with a good, steady demand, and sell for relatively high prices. Appearance has considerable to do with the price received, the bright, plump-looking pods bringing the best prices. In the general market, garden peas are commonly sold in the pod, although they are also sometimes sold shelled.

In the New York wholesale markets green peas are usually sold by the bushel basket, although they are also sometimes sold by the crate. An examination of the fluctuations of the prices of green peas in these markets for the 10 years from 1903 to 1912, inclusive, shows that variations of several hundred per cent. a month occur. The prices in the New York markets are taken because these are the largest markets in the country.

51. Green peas are now offered for sale in the New York markets every month in the year, the winter and early spring crop being shipped in from the South. The best prices are secured during the cold-weather months and early in the spring, and the top notch prices are secured in January, February, and March. The average prices are highest in March, when they begin to decline until July and August, at which time they are lowest; they then show a gradual increase through the fall and winter until the following March. Table I shows for each month the extreme low and high prices and the average low and high prices per bushel basket for green peas in the New York wholesale markets for the 10 years from 1903 to 1912, inclusive. These prices are figured from the average of the

low and high prices on the first and fifteenth of each month for the 10 years mentioned.

52. The market price of green peas is equally variable in the local markets supplied by market gardeners. The first peas in the market bring the best prices, and as they have a better flavor than those shipped in from a distance, they meet with a ready sale. In the New England States, where early

**TABLE I**  
**PRICES OF GREEN PEAS PER BUSHEL BASKET IN**  
**NEW YORK MARKETS**

Month	Extreme Prices		Average Prices	
	Low	High	Low	High
January.....	\$1.00	\$ 9.00	\$1.60	\$5.70
February.....	1.00	10.00	1.75	6.05
March.....	1.00	12.00	1.60	7.55
April.....	.50	6.00	1.12	4.50
May.....	.15	4.50	.59	2.95
June.....	.25	3.25	.52	2.23
July.....	.25	2.25	.54	1.60
August.....	.40	2.75	.69	1.62
September.....	.25	2.50	.60	1.93
October.....	.50	4.00	1.10	2.68
November.....	.50	5.00	1.00	3.35
December.....	1.00	6.50	1.50	4.55

home-grown peas are particularly in great demand, the prices for the first peas in the market in the spring will average from \$4 to \$5 a bushel. After the first rush is over the prices will quickly drop to between 50 cents and \$2.50 a bushel and remain at these figures for the rest of the season. As the crop cannot be grown and marketed at a cost of much less than \$1 a bushel, only the growers who get into the market early secure highly remunerative prices.

# TOMATOES

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## GENERAL REMARKS

1. The **tomato** ranks among the most important of the vegetable crops, and is extensively grown for market in every part of the United States, in Canada, in Central and South America, in Europe, and in Australia. The crop is grown both outdoors and under glass, and ranks as one of the three most important vegetable greenhouse crops. About one-half of the tomato crop is sold for consumption fresh, and about one-half is sold to the canning and catsup factories. Market gardeners and many truck farmers are concerned only with the culture of tomatoes for sale fresh.

Tomatoes reach the large markets every day in the year, and, except during the period of local production, they come from distant points where the climatic conditions are most favorable for their growth. Hence, many truckers consider tomatoes as one of their leading crops. Many market gardeners make either early or late tomatoes one of their leading crops, usually specializing on the extra-early crop, because the best returns can be secured from this crop. Tomatoes for the late crop can hardly be considered an extensive market garden crop. The tomato is grown very extensively in the South to supply the Northern trade.

2. Early in the 19th century tomatoes were commonly supposed to be unwholesome and by some even to be poisonous, and they were not generally cultivated in the United States until about 1835 or later. Since that time, however, tomatoes have rapidly increased in popular favor.

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Green tomatoes are eaten pickled. Ripe tomatoes are eaten raw and cooked, and are used in the preparation of soups, omelets, sauces, catsups, marmalades, and many other culinary preparations.

**3. Commercial Importance.**—The tomato is one of the most widely and largely grown of the vegetables. It is probably more extensively used in America than elsewhere, but its use is spreading rapidly, and European countries, particularly England and Australia, are now producing immense quantities. The tomato is a particularly valuable crop for many growers.

According to the census figures, the total value of the commercial tomato crop in the United States in 1909 was \$13,707,929, raised on 207,379 acres, distributed among 64,751 farms; this crop includes all the tomatoes grown on patches of 1 acre or over; trade estimates of the total acreage in tomatoes in the country are much higher, being from 400,000 to 500,000 acres annually. According to the census figures, there is an average of about 3.22 acres per farm on those farms which grow tomatoes commercially.

As might be inferred from the immense size of the crop, tomatoes are grown commercially in every state in the country. The ten principal states, ranking in the order of the crop produced, are: New Jersey, Maryland, Florida, New York, Texas, Delaware, California, Indiana, Ohio, and Virginia. These ten states produced more than 72 per cent. of the total crop; New Jersey alone produced more than 15 per cent. of the total, and Maryland and Florida each produced nearly as much.

The average income per acre from tomatoes for the country is about \$66. In each of the principal states, the average income per acre is: Florida, \$148; Texas, \$98; California, \$85; New York, \$83; New Jersey, \$80; Ohio, \$62; Maryland, \$45; Delaware, \$44; Virginia, \$41; Indiana, \$27. Many skilful growers, however, secure much higher gross returns than these. In Massachusetts, for instance, where the crop is grown most largely by market gardeners, the average income per acre for the state is \$219; in Connecticut, the average income per acre is about \$187.

The tomato canning industry of the United States is a large one, and ranks on about a par with that of sweet corn. The number of cases, containing 2 dozen cans each, which have been packed in the United States over a period of 5 years, are: 1908, 11,479,000; 1909, 10,984,000; 1910, 9,235,000; 1911, 9,749,000; 1912, 14,022,000.

**4. Characteristics of the Plant.**—The tomato is one of the solanum, or nightshade, family and is closely related to the potato, eggplant, and pepper. In fact, the tomato and the potato can be grafted on each other, but the graft will produce no practical results; these plants will not, however, cross. When grown in tropical or semitropical countries, the tomato might be considered a short-lived perennial plant, but in cold climates it is grown as an annual from seeds. The tomato is supposed to have originated in South America or in Mexico and was probably taken to Europe in the 16th century.

**5.** Under favorable conditions, the plants of the various varieties of tomatoes will ripen fruit in 85 to 120 days from seed; under less favorable conditions, as long as 150 days is sometimes required. Favorable conditions are considered to mean a growing season of about 85 to 120 days of full sunshine, a day temperature of 70° to 90° F., and a night temperature of from 50° to 75° F.; at 50° F. growth practically ceases. A tomato plant will normally continue to bear fruit for 50 to 60 days, after which it becomes weakened by the strain of fruit production and the attacks of insects and diseases; these unfavorable conditions cause a slowing up of the sap circulation, and this results in a weakened condition of the plant, and finally death from starvation. South of the latitude of Philadelphia, tomato plants that are set early in the spring will usually die late in the summer, and the fruit for the late summer and fall crops are secured, as described elsewhere, from later plantings.

**6.** In localities where the climate is especially suitable for tomatoes, as in the Gulf Coast States and in Southern California, tomato plants will often bear as long as 10 months. In some cases, tomato plants that have produced a full crop of fruit

will start a new growth of roots and leaves, the new growth commonly starting from the nodes on branches that touch the ground. Such plants may produce a second and a third crop of fair size. Each crop, however, is borne on new branches growing on new roots.

7. Many of the difficulties in the culture of tomatoes may be laid to the character of the roots of the plant. Although these are abundant, they are short and can secure plant-food and water only from a comparatively small space in the soil. Many other smaller plants have a larger and more efficient root system. For example, a garden bean plant that is less than one-half the size of a tomato plant, has roots that reach out farther than those of the tomato plant, and hence can draw nourishment from a much larger space; furthermore, the garden bean roots seem to be better able to absorb the required food. In addition to these disadvantages, tomato roots are also very tender and are not able to penetrate a hard soil with any great success. This fact emphasizes the necessity for thorough preparatory tillage.

The period during which tomato roots will grow and take up food and moisture rapidly is also short; this makes it important to prevent checking of the growth of the plants. Early in life the tomato roots become clogged up and sluggish in their action, and unless new roots are sent out the plant will shortly be starved and die. The growth of a plant may often be renewed if some of the branches become covered with earth, as new roots and branches will strike out; the old growth, however, is never renewed. If seasonal conditions are favorable, the crop on the second growth may be larger than on the first.

8. As in the case of the roots, the growth of the stems and leaves of young tomato plants is very rapid. These parts are made up of a coarse cell structure that contains little fiber. While it is young, this coarse, cellular matter will normally transmit nutritive matter very rapidly, but, like the roots, it soon becomes clogged and loses this power of rapid transmission. It is because of this coarse cellular structure that the active life of the leaves and stems is comparatively short, that a new, fresh

growth is necessary to maintain fruitfulness over a long period, and that renders the leaves of the plant particularly susceptible to injury from fungous diseases. To secure the proper active growth of the leaves and stems, however, an abundance of sunshine is necessary.

9. The blossoms are borne very abundantly on almost all tomato plants, and it is very seldom that a tomato plant does not produce sufficient blooms for a full crop of fruit. Tomato flowers are perfect; that is, each blossom contains both a male and female parts. Conditions of sunshine and warmth must, however, be particularly favorable for all tomato blossoms to be fertilized. The conformation and development of the flower is such that the stamens, or male parts, form a collar around the pistil, or female part; when full grown the pistil pushes out beyond the stamens. The blossoms hang down, and if the pollen ripens at the proper time, it will drop on the receptive end of the pistil tube and fertilization will take place. On outdoor-grown plants, if the pollen does not ripen at the right time, as often happens, the stigma is fertilized by pollen carried by the wind.

A long-continued spell of cold, damp weather will sometimes prevent the proper fertilization of the blossoms on outdoor-grown plants, and such unfertilized blossoms will drop off. The cold and rain interferes with the development of the blossoms and the ripening and the distribution of the pollen. Failure to set fruit cannot, however, always be attributed to cold, wet weather. A reduction of the vitality of a plant by the attacks of insects and diseases, an improperly balanced food supply in the soil, and too much water or an irregular supply will often produce the same results.

Insects, such as bees and others that carry pollen from blossom to blossom on many plants, seldom visit tomato blossoms, and hence no dependence can be placed in the fertilization of the blossoms by such means.

10. The original type of tomato plants, from which the present varieties have been developed by careful breeding during many generations, bore small fruits having a varying number

of cells from two upwards; many of these fruits contained little juice, had thin walls, and the cells were marked on the surface by more or less deep sutures. The fruit of the modern tomato has been developed so that: (1) it is much larger; (2) the cell walls are much thicker; (3) there is much more juiciness and the juice is of a better flavor; and (4) the sutures and roughness of the skin have been largely eliminated, the result being a smooth, attractive fruit.

The fruit of the tomato is greatly influenced by surrounding conditions. The quality varies with different varieties, but fruit of the same variety will also vary in quality according to the amount of sunlight it receives, the moisture supply in the soil, the supply of available plant-food in the soil, and the degree and steadiness of the temperature. As explained later, sudden changes in the moisture supply and in temperature conditions will injure the quality of the fruit and will reduce its attractiveness by causing cracks to appear on the surface.

**11. Cost of Production and Income.**—The cost of production of tomatoes varies considerably in different localities and according to whether the crop produced is an early or a late one, or whether it is produced for the canning factory. The cost of production for tomatoes is often stated at very low figures, sometimes as low as \$20 per acre; at such a figure little fertilization could be given and no allowance could be made for labor.

The estimates given on the following page for the cost of production of an early and a late crop of tomatoes for market have been made by an experienced grower and will serve as a good basis for other estimates, which estimates will vary with the cost of manure, fertilizer, labor, etc.

The income per acre from tomatoes varies with the selling price and the yield. Most growers can secure an average of 75 cents a bushel for early tomatoes; if an average yield of 200 to 400 bushels is secured, this will give an income per acre of \$150 to \$300; skilful growers in some favorable localities have been able to secure from \$700 to \$800 per acre. A price of 50 cents a bushel is probably more than most tomato growers get

for their late crop, but many market gardeners average this amount; if a yield of 300 to 600 bushels is secured this will give an income of about the same as for the early crop. In many large canning sections an average yield of about 10 tons per acre is secured by many growers; the contract prices for canning tomatoes vary from \$9 to \$11 a ton, making an income per acre of \$90 to \$110.

## ESTIMATE OF COST OF PRODUCTION

	EARLY CROP		LATE CROP	
Use of land.....	\$ 5.00 to	\$ 10.00	\$ 5.00 to	\$ 10.00
Plowing and harrowing..	4.00 to	6.00	4.00 to	6.00
Commercial fertilizer.....	7.00 to	15.00	7.00 to	15.00
Well-rotted manure, 5 to 10 tons.....	10.00 to	20.00	10.00 to	20.00
Plants for early crop (about 4,500 at from \$7 to \$15 per 1,000).....	31.50 to	67.50		
Plants for late crop (about 3,600 at from \$5 to \$8 per 1,000).....			18.00 to	20.00
Cultivation and hoeing...	10.00 to	16.00	10.00 to	16.00
Spraying, three to five times.....	6.00 to	10.00	6.00 to	10.00
Picking and packing early crop (200 to 400 bushels).....	20.00 to	40.00		
Picking and packing late crop (300 to 600 bushels).....			21.00 to	42.00
Total.....	\$93.50 to	\$184.50	\$81.00 to	\$149.00

The cost of marketing, which might or might not include transportation charges and commissions, would have to be added to these figures.

The cost of production per acre for tomatoes grown for the canning factory will be from 10 to 20 per cent. less than the lowest estimated cost for the late crop, or from about \$60 to \$70 an acre.

**12. Climatic Requirements.**—The tomato requires a long growing season, and, because of its somewhat tropical nature, does best only where there is an abundance of sunshine and a fairly uniform high temperature; it is tender to frost and unfavorably affected by cold, cloudy weather. A season during which there is an abundance of sunshine and during which the weather is excessively warm will always result in large crops of tomatoes. These statements must not be construed to mean that the tomato is an especially delicate plant and cannot be grown under adverse conditions, for this is not the case. The plant can be grown with more or less success under a wide range of conditions, and ideal conditions are necessary only when the crop is made a leading one commercially.

As previously explained, tomatoes will do best when the temperature runs as high as 75° to 90° F. during the day and does not drop lower than 55° F. at night. Such day and night temperatures, however, are seldom obtained. Preferably, the temperature should be equable. Sudden changes in temperature, especially sudden drops, have a bad effect on tomato plants by checking their growth and injuring their ability to bear fruit.

Because of the susceptibility of the tomato to frost, the young plants should not be set outdoors in the spring until after all danger of a frost is past, and, on the other hand, the plants should be set out in time for the fruit to mature before danger of injury from frost in the fall. In some localities, tomato plants are grown under glass to a rather large size, in order to shorten somewhat the growing season in the field.

At least a medium rainfall is necessary for the proper development of tomatoes, unless water can be supplied artificially by irrigation. The ideal moisture conditions are supplied when the moisture falls on the crop evenly throughout the season. In many localities, not excepting many in the humid climates, irrigation in some form is much more dependable than rain.

**13. Soils.**—The tomato has been adapted to a wide range of soils, from light sandy ones to the heaviest of clays, and as far as the successful and vigorous growth and productivity of

the plant is concerned, the only requirements are good drainage and an abundance of plant-food. The factor of earliness is, however, usually much more important to the market grower than any other, and for this reason market gardeners and truck farmers usually select a sandy loam that is well-drained and not leachy. Sandy soils are popular also because their texture is not so much injured by tramping in wet weather and the cost of tillage is not so great as on clay soils. In different sections of the country the yields on different types of soils have been rather contradictory. In some sections the heaviest yields have uniformly been secured on sandy soils; in others, on heavy soils. Many of the variations in yield have no doubt been due to conditions of drainage and fertility and to management. Many canning factories prefer tomatoes grown on heavy soils, the reason given being that the flesh of tomatoes grown on such soils is usually more firm and meaty than of those grown on sandy soils. Early varieties of tomatoes are usually smoother and better formed when they are grown on sandy soils.

When an early crop is desired, careful attention should be given to the location and exposure of the tomato field. The vines should be located so that they will be protected from heavy, steady-blowing winds, especially those from the north and west. The earliest maturity is secured on southern slopes, where the ground will warm up early in the spring.

## VARIETIES, SEED, AND PLANT PRODUCTION

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### VARIETIES

14. The varieties of tomatoes are so numerous, the variations in different strains are so marked, and the area of production is so extensive that the variety and strain question is similar to that described for lettuce. More than 300 varietal names for tomatoes may be found in American seed catalogs, and nearly as many are listed by European seedsmen. Probably more than half of these names are duplicated, and in some instances there may be a dozen names for one variety. To add to the confusion, all the seed that is sold to grow the same variety will not produce plants of uniform type. The variations in type are due to the fact that: (1) there is no generally accepted standard by which to measure any variety; (2) the climate and soil in different localities have an important effect in promoting variation; and (3) the ideas of different plant breeders vary so widely that two are seldom found to select the same type.

15. The ideal market type of tomato is round or somewhat oblate, has a smooth surface, and is medium to large in size; the flesh should be meaty and rather solid, of good quality and of a solid, even color that is characteristic of the variety; seeds should be few; the fruits should ripen evenly and early; and the vine should be an abundant yielder.

Unfortunately, the earliest varieties of tomatoes rarely possess all of the characteristics which determine the highest quality. They are usually lacking in solidity of flesh, flavor, even ripening, and smoothness of outline in the fruit. These qualities of the ideal have to be sacrificed to some extent to obtain earliness and a heavy yield. An improvement in quality of early tomatoes without the sacrifice of earliness is, however, being

constantly striven for by the best seedsmen, and is gradually being attained by means of selection, cross-breeding, and high culture. Improvements in this line result in the production of a great number of new varieties; the newer ones that have stood the test in commercial production should be used, and the older, less desirable kinds dropped.

16. The varieties of tomatoes may be classified in many ways. For practical purposes, however, they may be classified as **large-fruited varieties** and **small-fruited varieties**. The large-fruited varieties are much the more important commercially, the small-fruited varieties being seldom grown except for pickling, etc.

The large-fruited commercial varieties may be divided into three groups: (1) The *first-early* varieties, (2) the *second-early* varieties, and (3) the *late*, or *main-crop*, varieties. These groups may be further subdivided according to the color of the fruit, as crimson and pink; there are also yellow kinds, but these are seldom grown for market. Other groupings may be made, on other qualities, such as the character of the vine, but, in regard to vine growth, the commercial grower is interested only in knowing whether the vines are large or dwarf.

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#### LARGE-FRUITED VARIETIES

17. **First-Early Varieties.**—The well-known Earliana tomato is the most extensively grown of any variety of the first-early class. There are many strains of this variety and these vary considerably in their commercial value.

18. The **Earliana** tomato, illustrated in Fig. 1, has a vine that is only a moderately strong grower; the leaves are rather light green and small. The blossom clusters form early, often before the plants are taken from the frames for transplanting in the field, and, when properly handled, the vines will bear fruit as early as any kind on the market. The fruit is considerably flattened and has a tendency to be rough about the stem end; this roughness is particularly noticeable in some of the poorly-selected strains. The fruit is scarlet, light in weight,

rather watery, and not of the best quality. The yield of the vines is only moderate. The tomatoes of this variety, and of other kinds that have a similar appearance, bring low prices in the markets when the better sorts of the second-early varieties get into the market. The Earliana is planted very extensively and has not, as yet, been equalled in earliness by any of the varieties that are superior in quality.



FIG. 1

Some of the strains of the Earliana that have been developed of recent years are superior to the general run of this variety. These strains have been bred so that the fruit they produce is smother, rounder, and possesses more solid flesh than the more common type; in some strains this has been accomplished without loss of earliness.

**19. Second-Early Varieties.**—The second-early class includes many of the widely-known varieties. They are both crimson and pink in color, and large and dwarf in growth. The

crimson varieties are the most popular, but in a few markets the pink varieties sell for higher prices. Two of the best of the second-early varieties are Chalk's Early Jewel and the Bonny Best, other good second-early varieties are June Pink, Dwarf Champion, Acme, and Livingston Globe.

**20. Chalk's Early Jewel** tomato is shown in Fig. 2. The plant is a somewhat stronger grower and heavier yielder than that of the Earliana. The fruit is of medium size, smooth, and somewhat flattened; the flesh is more solid than that of the Earliana and somewhat better in quality. This variety is similar to Earliana in many respects, but in it the undesirable features of the earlier kinds have been removed at a sacrifice of a week or more in earliness.



FIG. 2

**21. The Bonny Best** tomato vine differs but little in its character of growth from that of the Chalk's Early Jewel.

The varieties differ mostly in the size of the fruit. Where large fruits are desired the Chalk's Early Jewel will be the most suitable variety to grow, but the Bonny Best is the better variety for the production of medium-sized, uniform fruits of high quality.

**22. The June Pink** tomato is the most widely grown of the second-early varieties that produce pink fruit. In vine growth, yield, and general characteristics of the fruit this variety is very similar to the best strains of the Earliana, and in quality is much better; often the quality will fully equal that of

**Chalk's Early Jewel.** The June Pink is probably the best kind to grow for the production of the earliest pink tomatoes.

**23.** The **Dwarf Champion** tomato is popular in many sections. The plant is distinctive looking, with thick stems and dark green, thick leaves; the plant is almost strong enough to stand in the field without support even when loaded with a crop. Under intensive culture, the plant will yield well and may be planted closer in the field than the large-growing kinds. The smaller specimens of the fruit are nearly round and the larger ones are somewhat flattened. The fruit is very smooth, usually free from cracks, of a good pink color, and of high quality; it

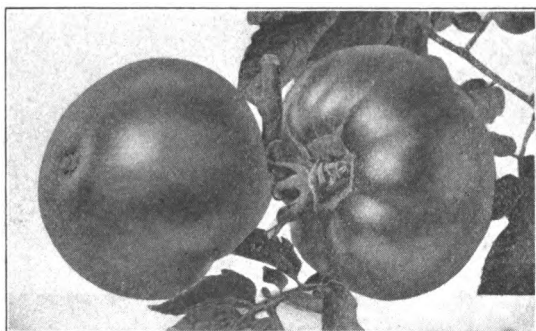


FIG. 3

is borne in short-stemmed clusters of six or eight. In addition to being good for market this variety is very popular for the home garden. The young plants have a strong, sturdy appearance, which makes them appear attractive when offered for sale in a flat, and hence they are among the best sellers to persons who plant a few tomatoes in the home garden. It would be unwise to plant this variety for market where the crimson sorts are preferred.

**24.** The **Acme** tomato is a standard pink variety, and the **Livingston Globe** tomato is a round, pink variety of fine quality. Both of these varieties are of the second-early class and are of more or less use for commercial plantings; they are very good for the home garden.

**25. Late Varieties.**—There are a number of the late varieties of tomatoes, and one of the best of these is the Stone.

**26.** The **Stone** tomato is shown in Fig. 3. The vine is strong growing and rather spreading in its habit of growth; the plant matures its fruit rather late, but under favorable conditions, it will mature a large number of big, handsome fruits. The fruit is somewhat oblate, very smooth, an even, deep crimson in color, very heavy, has meaty flesh and comparatively few seeds, and is of excellent quality. No variety grown exceeds a good strain of Stone in quality and productiveness. There are, however, many strains and some are not so good as others.

**27.** The **Matchless** tomato is a splendid late variety that rivals the Stone in quality and yield, but which has not been grown to any great extent on a commercial scale.

**28.** The **Dwarf Stone** tomato has been produced from the Stone. The vine is similar in habit of growth to the Dwarf Champion. The fruit, however, is large and red, but somewhat smaller than that of the Stone.

**29.** The **Ponderosa** tomato is a very popular, late, home-garden variety, and yields heavily. The vines are a light green and spreading in their habit of growth. The fruits are larger than those of any other variety, are pink in color, and of good quality. The fruits, however, are frequently too large and too irregular for market.

**30.** The **Golden Queen** tomato is the best of the large-fruited yellow varieties. There are, however, a number of good yellow tomatoes among the small-fruited varieties.

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#### SMALL-FRUITED VARIETIES

**31.** The small-fruited tomatoes are used largely for pickling and canning. They are not extensively grown as commercial varieties. The principal varieties are the Plum, Pear, Peach, Cherry, and Strawberry tomatoes.

**32.** The **Plum** tomato, shown in Fig. 4, grows on a vine that is very similar in appearance to the vine of the first-early large-fruited varieties; that is, the stems are rather slender and the leaves are small. The fruit is borne in long clusters, of from five to twenty; and is about the size of a medium-sized plum. Some strains bear red and some bear yellow fruit. The flavor of this tomato is good, is somewhat sweeter than that of the large-fruited kinds, and the tomato is of good quality for preserving. The vines are productive; single vines will often yield several quarts. The fruits are often sold in berry baskets.

**33.** The **Pear** tomato differs from the Plum tomato principally in the shape of the fruit. The Pear tomato is shaped very

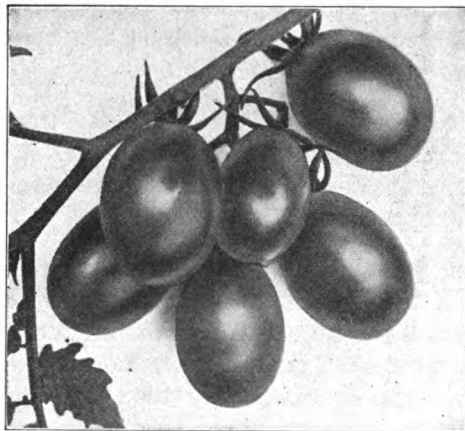


FIG. 4

much like a typical Bartlett pear. The fruit is borne in long clusters similar to those of the Plum tomato and is of similar commercial value. There are both red and yellow strains.

**34.** The **Peach** tomato is of a different class from the Plum and Pear tomatoes. It grows to the size of a small peach,

is nearly round, and the skin is velvety, it is of a pale red color, and when ripe resembles a small well-colored, white-fleshed peach. It is good for pickling, preserving, and exhibition.

**35.** The **Cherry** tomato is one of the smallest but one of the most handsome of the small-fruited sorts. The fruits are almost perfectly round, are borne in long, narrow clusters like the Plum and Pear tomatoes, and on some kinds the fruit is a bright red and on others a bright yellow. The fruits will average about  $\frac{1}{2}$  inch in diameter. They are used for pickling.

36. The **Strawberry** tomato is also called the *Winter*, the *Cherry*, and the *Husk* tomato in different sections; the term cherry should not be applied to this tomato, as it is both inaccurate and confusing. The fruit of the Strawberry tomato grows within a thin, paper-like husk, which may be easily rubbed off when the fruit is ripe; the berry like fruit in this husk is yellow and is about  $\frac{1}{2}$  inch in diameter; it is very sweet, and is one of the best for preserves. This variety is popular for preserving, and on this account it finds a more or less active sale in many markets during the fall.

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#### SEED AND SEED PRODUCTION

37. Tomato seed can be successfully grown in all parts of the United States. Many of the leading seedsmen of the country make tomato seed their speciality and either grow their stock on their own seed farms or have it grown for them by specialists under their supervision. Some seedsmen get their supply from the canning and catsup factories. On account of its cheapness, this seed is attractive to many. Such seed, however, is entirely unreliable. It may show a good germination test and hence appear to be good from this point of view. The inferiority of this seed is due to the absence of selection and breeding. The seed will come from many different crops, and consequently from many different varieties or strains. The fruit produced from such seed cannot be expected to be uniform and true to a distinct type.

38. The tomato can be remarkably improved and adapted to local conditions by careful selection. The requirements for successful breeding are similar to those for other plants. The first essential is that the seed grower have a clear, definite idea of the ideal type of plant and fruit which he is aiming to produce; this ideal should be strictly adhered to and should not be changed thoughtlessly, as is often done. Such an ideal can be obtained only after a careful study of the variety and strain under consideration. When it is obtained it should be written down in great detail so that it will always be ready for reference.

After obtaining a clear conception of the ideal for any particular variety, the next steps in practical breeding are: (1) Seed should be secured from plants that conform most nearly in all details to the ideal; seed should be selected from a strain that has been true and fixed for at least a number of generations, and that has not been changed by cross-pollination with other strains. (2) Seed should be taken only from a strain of plants that have been proved to develop true to type from the seed, and in which each successive generation has been found to be strongly prepotent; otherwise a strain may soon run out.

Some tomato-seed growers attempt to produce desirable qualities in plants by cross-breeding—that is, by crossing two strains each of which has certain desirable characters in the hope that the hybrid will receive the best characters of the two. Such a method of breeding is usually unsatisfactory, because the crossing brings in factors of which the breeder has little or no knowledge until after he has spent a long time in experimenting. The best results are usually obtained by line breeding in a certain well-known strain. After any crossing, line breeding is also resorted to.

**39. Line breeding** for tomato plants can best be explained by the description of a concrete example. For purposes of illustration, let it be supposed that the type of tomato desired is similar to the Earliana, but that it is to be earlier, smoother, have more solid flesh, and, if possible, be a stronger grower. At the start, it must be understood that certain qualities of an opposite nature cannot be combined in the same plant, or that any combination of them must be somewhat at the expense of one or the other. For instance, large size of fruit and extreme earliness of ripening are practically impossible to secure on the same plant, or, at least, growers have so far been unable to secure these desirable results.

The detailed method of handling the plants in line breeding is as follows: Ten Earliana plants should be selected from a field of 1 acre or so in extent. These plants should, of course, be the best on the field. They should be superior to the others in the desired characters previously mentioned, and the fruits

on all of them should be as nearly ideal as possible. Four of the earliest ripening and most symmetrical and attractive-looking fruits from each of the ten plants should be selected after they have become well ripened; these plants should be numbered from 1 to 10, the seeds of each lot extracted separately as described later, and each lot of seed numbered to correspond with the fruits from which they came. The following season the seed should be sown and proper care given to the seedlings until the time for field setting. The seed from each lot should be sown in such a way in the hotbed that each lot can be kept distinct; sometimes a single hotbed sash is devoted to the seed of each lot. At transplanting time from ten to twenty-five of the best of the seedling plants of each lot are set in the field. Ten plots should be arranged and the plants from each of the original ten lots should be separated in these. The seedlings that are not used in this way may be planted in a field along with other seedlings for a regular market crop.

As the season progresses the plants in each plot should be studied and differences noted. The plants which conform most closely to the type desired should be marked by driving a stake in the ground alongside of them. When the fruit matures another examination should be made and only the fruit from the one, two, or three best plants in a plot should be saved for seed. Possibly in four or five of the plots no plants will be found that will approach the ideal closely enough; in this case all the plants in these plots should be discarded for seed purposes. The remaining plots should retain their original numbers, however, to avoid confusion. If more than one plant is selected for seed production from a plot, the seed from the different plants should be kept separate and should be marked No. 1 (a), No. 1 (b), No. 1 (c), No. 2 (a), No. 2 (b), No. 2 (c), etc., or in some other simple way. The characteristics of each plant from which the seed is retained should be carefully noted on paper; usually this is done in a book and the sheet is headed with the number of the plants, as "No. 2 (b)."

The breeding work should continue in this way until a tomato is obtained which the grower is satisfied is the best obtainable. If carefully done, such work usually gives good results.

40. A great many seedsmen grow seed by selecting the plants as just described and then give this seed to farmers, who grow a crop from it and sell it under contract to the seedsman for from 40 or 50 cents to \$1 a pound. As the yields of tomato seed are from 75 to 250 pounds per acre, and the seed can be produced for from 10 to 15 cents a pound, including the separating of the seed from the pulp and washing, this makes a satisfactory return. Some growers throw the pulp away and others make it into catsup. Other seedsmen grow the seed in this way on their own farms, saving and selling all the seed that is produced by the plants raised from the line-bred seed.

41. When large quantities of seed tomatoes are handled, the seeds are separated from the pulp by special machines, which are usually operated by a horse or by some other inexpensive means. When small

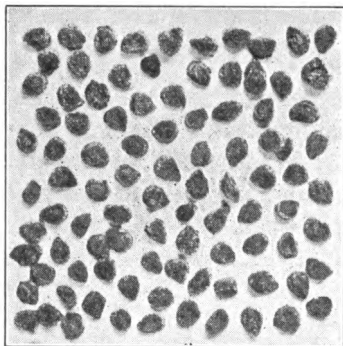


FIG. 5

quantities of seed tomatoes are handled, the ripe fruits are usually mashed with a potato masher in a bowl, and much of the pulp may then be washed from the seed. The particles that cling to the seed are allowed to remain for a few days. The entire mass, including the seed with these pieces of pulp attached, are placed in water and allowed to remain there until

fermentation softens the pulp so that it can be readily washed from the seeds. The fermentation should not be allowed to continue too long, or the germinating power of the seed may be injured. As soon as the seed is clean, it should be dried in the sun, rubbed between the hands to clean it of all adhering particles, and placed in paper bags. The seed should be stored where the air is dry and where the temperature is fairly even.

42. Tomato seed is of moderate size. From 8,500 to 11,500 weigh 1 ounce, and 1 quart weighs about 11 ounces. A sample of Stone tomato seed is shown natural size in Fig. 5.

43. When kept under favorable conditions, tomato seed is long lived. The average period of satisfactory germination is about 4 years, and the extreme limit is about 9 years. Usually, however, commercial growers seldom use seed more than 2 years old. To be considered high grade, tomato seed should be 99 per cent. pure, and about 94 per cent. of the seed should germinate. The germination test, however, does not necessarily indicate that the seed is particularly desirable to use; many of the mixed lots of seed from a canning factory will show a good germination test.

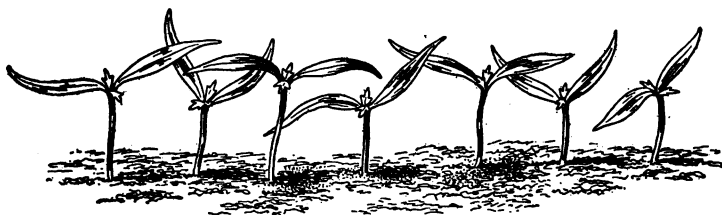


FIG. 6

44. Under favorable conditions, tomato seed should germinate in from 6 to 12 days. A few tomato seedlings are shown natural size in Fig. 6.

45. At the usual distances of planting, 1 to 4 ounces of tomato seed should produce enough young plants to set 1 acre; many growers estimate that 1 ounce of the finest quality tomato seed will produce 3,000 to 4,000 good plants for transplanting. A small package of seed should produce enough plants for setting about 100 feet of row.

46. The price of tomato seed varies greatly with the quality, the reputation of the seed grower, and the variety. The best seed of different varieties or strains will retail at from \$3 to about \$5.50 a pound in pound lots.

### PLANT PRODUCTION

47. The production of tomato plants for setting in the field and garden is a large business, fully as large, if not larger, than the production of cabbage plants for the same purpose. Tomato plants are sold in larger numbers at retail to home gardeners than any other vegetable plant grown, and their commercial use is hardly less extensive than that of the cabbage.

48. The tomato plant requires from 130 to 150 days to ripen fruit from the time of seeding, and the plants will continue to ripen fruit after this for a considerable time, often until frost or the attacks of diseases or insects terminate their life. For from 60 to 90 days of the period of growth, the plants are commonly handled under glass before being set in the field. Consequently, in the latitude of New York City, this necessitates sowing the seed under the glass from February 15 to March 15. The exact time required for growth under glass and the time for planting under glass varies with the variety, the care given to the plants, and the size of plants required for field setting.

49. The production of the young tomato plants is of fundamental importance in the growing of a crop of this vegetable. To produce the best results, a tomato plant must have a slow, steady, strong growth from the time the seed is planted until harvest. A check in the growth of the plant at any stage lessens the yield, and, unless properly handled, the checks that may be received while very young will be particularly injurious. Too rapid growth can scarcely be carried on without a check somewhere, and such growth produces an undesirable, spindling plant.

The mistake should not be made of planting tomato seed so early that the plants will need to be checked later in order to prevent them from becoming too large for field setting. It is always considered much better to have the plants a trifle undersized at transplanting time than to make it necessary to check them in the frames. For this reason, many growers in the latitude of New York City prefer to sow tomato seed about March 1.

50. As the tomato plant thrives best at comparatively high temperature, the night temperature in which the young plants are held under glass should never be lower than 50° F., nor is it safe to run it higher than 65° F., except perhaps for the first few nights after the seed has been sown. The day temperature should be maintained between 70° and 85° F. In a greenhouse, temperature regulation is much simpler than in a hotbed, because the supply of heat can be varied and the cold air let in at will to reduce too high a temperature. However, great quantities of tomato plants for field setting are grown in hotbeds, and the directions for handling the plants in these will be considered in detail. The importance of maintaining a proper temperature in a hotbed in which young tomato seedlings are growing should be thoroughly understood. A serious chilling of the seedlings for one night will spoil the growth of several weeks, and if the plants are rather far advanced they possibly cannot be replaced in time during that season. In such a case, not only would the cost of production of the young plants be wasted, but the possibility of securing a crop of tomatoes that season would be lost.

In order to be able to maintain a night temperature of at least 50° F., from 1 foot to 15 inches of horse manure should be packed in the lower part of the frame, and if the seed is to be sown as early as February 15, about 18 inches of horse manure will be required. Furthermore, this manure must be of good quality for heating; that is, it should be made up of about one-third straw and two-thirds clear horse manure. It should not be fire-fanged, or burnt from overheating, should not be moldy, and should not contain any shavings. In preparing the manure for the frames, it should be placed in piles and allowed to warm up somewhat, and when put in the frame it should first be thoroughly shaken out and packed in evenly; the outside portions of the piles, which will have largely lost their heat, should either be discarded or should be thoroughly mixed with the hot manure; if any considerable proportion of this cold manure is placed in any one frame, the heating will not be satisfactory.

The depth of soil that should be placed over the manure in a hotbed will vary with the method of growing practiced; that

is, whether the seed is sown directly in the soil of the frame or whether it is sown in flats. When the seed is sown directly in the soil of the frame, from 4 to 6 inches of a rich, mellow, loam soil should be placed over the manure, according to the heating qualities of the manure. When flats are used, 2 to 4 inches will be sufficient. The soil used should be mellow, well filled with humus, sweet, and should feel velvety to the hands.

**51.** Special care must be taken in regulating the moisture in the soil and in the air of the hotbed. Excessive moisture is likely to result in a loss of the plants, especially if the moisture is present at night. The best plan is to water the soil in the bed well before the seeds are put in and then not to water the plants at all for the first 2 or 3 weeks, if they can be kept growing satisfactorily without it. This, of course, will depend much on the nature of the soil used, the quantity of humus in it, the way in which the ventilation is conducted, and the amount of sunlight. Plants of this kind should be kept a trifle too dry rather than a little too moist.

**52. Sowing of the Seed.**—Tomato seed for the production of seedlings for transplanting in the field may be sown in flats or in the soil of the hotbed. The first method has much to recommend it. If sown in flats, the general directions given for cabbage will apply to the sowing of the seed and to much of the handling. The same sized flats, or boxes, should be used, and the transplanting is done in the same way and with the same tools. After the seed is sown, the boxes should be labeled with the name of the variety and placed in the hotbed. If the seed is to be sown in the soil of the frame, the rows should be spaced from 3 to 4 inches apart and from 5 to 8 seeds sown to the inch.

The seed will germinate in from 6 to 12 days, and the seedlings will grow rapidly. They should not be allowed to stand so thick that they will crowd each other and grow long, spindling stems. At this stage of the growth, under glass, a low temperature of about 50° F. at night and from 65° to 70° F. during the day will tend to lessen the rapidity of growth of the top and to stimulate the growth of the roots.

**53. Transplanting of Seedlings.**—The transplanting of tomato seedlings in the seed-bed is essential. One transplanting at least should be made before the plants are transferred to the field. Two are recommended by most progressive growers, and many find that they can get the best results from three, the final one being made in pots. The transplanting of tomato seedlings produces a more compact, stocky growth of plant and a root system that is thick and developed within a small radius, and a plant of this kind, when transplanted to the field, will suffer much less check than a spindling plant; hence, other conditions being the same, such plants will yield earlier and more fruit than plants that have not been transplanted.

The first transplanting should be made from 3 to 4 weeks after the sowing of the seed, or at about the time when the second pair of leaves begin to show. At this stage they are of a size that can be easily handled, and should have a root about 2 inches long and somewhat branched.

The distance the plants should be spaced in their new places at their first transplanting depends on whether they are to be transplanted a second time or not. If two transplantings are to be made, the plants should be spaced 3 in.  $\times$  3 in.; if only one transplanting is to be made, they should be spaced 5 in.  $\times$  5 in. When those planted at the close distances begin to crowd, they are transplanted at the greater distances. If they are set closely and not transplanted a second time, the growth will be spindling.

The work of transplanting is done in much the same way as for cabbage seedlings. The young plants should be handled with care. They should be loosened from the bottom by running the finger under them. At this time, it is advisable to have the soil moist enough so that the roots will hold a good lump of it. Only a few plants should be lifted at a time, and they should be set in their new places immediately, so that the roots will not dry out. When properly handled, the plants should scarcely stop growing.

If the plants are to be transplanted into flats, drainage should be provided in the bottoms of these, as previously explained, either by boring holes in the bottom of the flats or

by leaving a small space between the bottom boards; in this way, injury from excessive moisture should be avoided. Flats 24 in.  $\times$  18 in. in size are convenient for use. When the plants are spaced 3 in.  $\times$  3 in., such a flat will hold about sixty-three plants.

54. Immediately after seedlings are transplanted the first time, if the sun is hot, the plants should be shaded somewhat during the heat of the day. This will usually be necessary only the first day, because within the first 24 hours the roots should begin to take up water in their new position. The transplanted seedlings will need but little watering during the cold weather of February and March, but the soil should not be allowed to become overdry. A night temperature of about 50° F. and a day temperature of about 70° F. will keep them growing nicely. If the temperature and moisture both stay above normal for any length of time, the damping-off fungus is almost sure to kill many plants. After the plants are once well started, all the sunlight available should be admitted to them, and they should also have all the air that the outside temperature will permit.

55. The second transplanting should take place in 3 to 4 weeks after the first, or from 6 to 8 weeks from the time of seeding. At this time the plants set 3 in.  $\times$  3 in. should be so crowded that the main stem will commence to stretch up. This should never be allowed to continue for any length of time or the plants will become *leggy*. The plants should be from 3 to 4 inches tall and the tops should interlace. At the second transplanting, the seedlings may be set in the soil of other hotbed frames, but preferably they should be set in other flats, or in strawberry baskets, pots, or dirt bands. Many growers make a third transplanting into pots. At this second transplanting, the seedlings should be set 5 in.  $\times$  5 in. in other flats. If set in pots, the pots should be at least 4 inches in diameter. Strawberry baskets are suitable but take up too much room for the commercial grower, and can only be used once. Paper pots can be made or purchased. Many good forms are on the market. The advantage secured by growing the seedlings in pots or

baskets is that the roots are confined in a small space, are not broken when the plant is set in the field, and hence the plant suffers no check.

In potting tomato plants in clay pots it is important that some drainage should be provided. Coal cinders placed in the bottom of a clay pot are good for this purpose. A small pile of cinders should be kept near at hand for use in potting. A few cinders should be put in the bottom of each clay pot, then some earth put on top of that, the plant set in, and then more earth put in and firmed around the plant. Soil alone is put in paper pots, etc.

The second transplanting will take much more time than the first and will require more care. It will, however, increase the stockiness of the plant and the fibrous root system and develop a plant that will fruit early. Careful handling is necessary to avoid an unnecessary disturbance of the root system. A good plan is to cut the soil in the boxes into squares by running a knife along midway between the plants. This will leave a small block of soil about 3 inches square to be lifted with each plant, and the root systems need be disturbed very little. In order for this work to be done well, the soil will need to be fairly moist, but it should not be soggy.

**56.** After the second transplanting the plants should receive special care for a few days, or until after they get accustomed to their new surroundings. At this season of the year the days will be long, the sun will normally be bright, and the growth will be more rapid than formerly. Hence, until the plants are well established, they should be shaded somewhat in the middle of the day and should be kept rather cool. The night temperature should be about 50° F. and the day temperature about 65° F. Little moisture should be applied unless there is danger of wilting. All the air possible should be admitted to the frames without allowing too much draft or lowering the temperature too much.

If the plants are put in pots at this second transplanting, the pots should be sunk in the soil of the hotbed so that the tops of the pots will come about level with the top of the soil. The

principal difficulty with potted plants is to keep the moisture conditions right. If a pot is not surrounded with earth, the soil on the sides of the pot will dry out almost as rapidly as that on top, and a dry crust will be formed near the bottom, where the soil should be moist. Plunging, or sinking, the pots in the soil materially assists in maintaining proper moisture conditions in them.

**57.** The most desirable tomato plants are short and stocky, and special pains must often be taken to produce such plants. When young tomato plants under glass begin to grow long, or leggy, it is due to one of two causes: (1) Too much heat, or (2) too close quarters. In a hotbed an excess of heat can be easily prevented by means of ventilation. If there is not enough headroom between the plants and the glass at the low end of the frame and the weather conditions are not especially severe, the glass sash may be raised by nailing strips of boards to the sides and front of the frame, so that the sash can rest on these and the air still not be permitted to enter any more than formerly; the corners should be well fitted to prevent this. The plants should not, however, have too much headroom, because they do better when kept comparatively near the glass.

As soon as the young tomato plants have started into growth after the second transplanting, many growers pinch off the terminal bud in order to stimulate the development of good side branches and to make the plant more stocky. If the plants are of an early variety, about 3 weeks after the second transplanting they should develop fruit buds and blossoms. Most growers nip off this first cluster of buds, because their development lessens the growth of the vine and retards the appearance of other and more numerous blossom clusters.

In the latitude of New York City, the young tomato plants should be ready for field setting about May 15, or a little later. Potted plants ready for transplanting are shown in Fig. 7. The plant in (a) is strong and stocky and of the best kind for transplanting; the plant in (b) is too tall, or leggy.

**58. Making of Paper Pots.**—Paper pots suitable for tomato seedlings and for many other plants may be easily made

at home out of strips of waterproofed cardboard or heavy paper, with the aid of the materials and tools shown in Fig. 8 (*a*). At *a* is shown a small tack hammer; at *b*, a small block of wood with an iron bolt *c* through it; at *d*, some small tacks; and at *e*, some strips of waterproofed cardboard cut to the required length. The block of wood *b* may be made out of any wood,



FIG. 7

but some soft wood like pine is easiest to handle. It is made 3, 4, 5, etc., inches square and of the desired depth of the pot; commonly the block is made cubical. A hole sufficiently large to admit the bolt *c*, which need not be more than  $\frac{1}{4}$  inch in diameter, should be bored through the middle of the block as shown. A corresponding hole should be bored through the table or bench on which the block is to be set. Then the iron

bolt *c* should be run through the block and its support, so that the head of the bolt rests on top of the block, and the nut should be screwed on underneath the table.

The strips of cardboard or paper *e* should be cut as long as five and one-half or six times the length of one of the sides of the block; this will enable the paper to be placed around the block with an ample lap; some persons economize on paper by cutting the strips just long enough so that there will be a  $\frac{1}{2}$ -inch lap on one side; this is not good policy, as such pots are weak; pots with only a  $\frac{1}{2}$ -inch lap on the side may have to be fastened

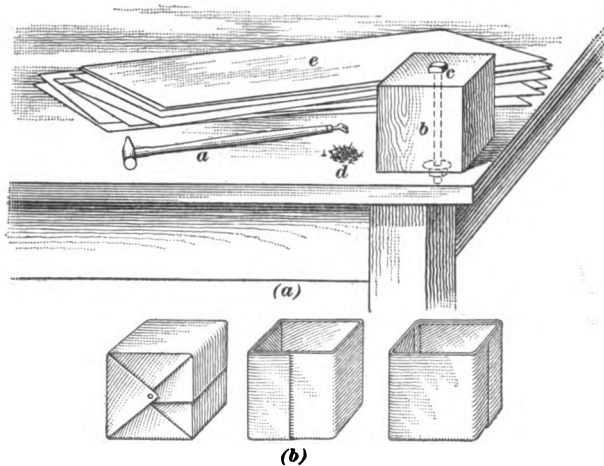


FIG. 8

on the side to prevent that side from gaping open, and this adds more in labor expense than the extra paper is worth. The strips of paper should be cut wide enough so that after the paper is wrapped around the block, the ends will be long enough to fold over the top of the block with a  $\frac{1}{2}$ -inch lap at the center, or just above the bolt head. Thus, for the making of a 4-inch pot, the strips of paper should be cut about 22 to 24 inches long and about  $6\frac{1}{2}$  inches wide.

The operation of making the boxes is simple. The paper should be wrapped around the block and the ends folded down on top. A small tack should then be pounded through the

folded paper in the center over top of the iron-bolt head. As the tack goes through the paper the point will be turned over and clinched; when properly applied, a clinched tack will hold the paper securely in place. Different views of a paper pot made as described are shown in Fig. 7 (b). Paper pots can be made in this way in much less time than it takes to tell about it.

If not more than a  $\frac{1}{2}$ -inch lap of the paper is allowed on the side, this may have to be fastened with a tack also. In such a case a small, flat piece of iron should be fastened against the side of the block next the table. The paper should be wrapped around the block so that the fold comes over this piece of iron. Then if a tack is driven through the fold, it will be clinched over and will keep the paper from gaping.

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## PLANTING AND GENERAL OPERATIONS

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### FIELD PLANTING

59. The soil for tomatoes should be made as warm and friable as possible. It should be plowed and well harrowed 2 or 3 weeks before the time for planting the crop, and a few days before the plants are to be set out it should be harrowed again, first with a deep cutting harrow and then with a smoothing harrow.

60. The manure and much of the fertilizer required by the tomato crop is applied before or at the time the plants are set. This is discussed in detail under the heading Fertilization.

61. The time for setting out tomato plants varies with the locality and with the season. Every effort is made to get the plants in the field early so that marketable tomatoes can be secured early, but nothing is gained by setting out the plants so soon that their growth will be stunted by cold nights. In the latitude of New York City, tomato plants are usually set out about the middle of May, but in some seasons growers who delay the planting somewhat will obtain better results than

those who plant according to a prescribed schedule. In the latitude of Boston, tomatoes are set about 10 days later. In the trucking sections about Norfolk, Virginia, tomatoes are set out in April and May, and in Georgia tomatoes are set out during the first part of January. In Idaho, tomatoes are set in the field about June 1, and on the Pacific coast the dates for planting are similar to those on the Atlantic coast in the same latitudes; thus, in Southern California, tomatoes are planted about the first week in January.

Growers who desire to maintain a good yield of tomatoes throughout the season and to produce fruits of the best quality, make two settings of the plants in the field. The seed for the production of plants for the second setting may be sown at the same time as for the early plants, or 1 or 2 weeks later. The late varieties mature somewhat more slowly than the early kinds and are set later so that their growth in the field will be more certain to proceed unchecked and they will continue to yield well until frosts kill the vines in the fall.

62. A continuous production of tomatoes can seldom be secured from one set of plants, because the tomato vine seems unable to continue its growth through a long bearing season without a renewal of its root system. If a plant is staked, there is no chance for such a renewal, but, if the vine is allowed to lie on the ground without being disturbed, new roots will often strike out from the joints, take hold on the soil, and put new life into the plant. If a plant is forced to depend entirely on its original root system it will cease to bear well after a few weeks. This is particularly noticeable where the soil or climatic conditions have been unsuitable or the plant has been checked by some cause during its growth. Such unfavorable conditions develop a hard, woody tissue in the old roots, which will not carry sap so readily as the tissue in new, succulent roots; this results in the partial starvation of the top. It is because of the development of hard, woody tissue in the roots that the early tomatoes are rarely able to grow vigorously until fall; as the early varieties of tomatoes are of inferior quality, however, there is no necessity of continuing their growth after the extreme

early part of the season. Better tomatoes can be secured from the vines of the later varieties later in the season.

**63.** The proper distances for planting tomatoes will vary with the variety, the productiveness of the soil, and the method of training. The early varieties are set closer together than the later ones, because they do not have such a vigorous vine growth. Early varieties are set 3 ft.  $\times$  3 ft. (about 4,840 plants per acre), 3 ft.  $\times$  3½ ft. (about 4,150 plants per acre), and 3½ ft.  $\times$  4 ft. (about 3,110 plants per acre), according to the soil, etc. Late varieties may be placed 3½ ft.  $\times$  4 ft., but are more often spaced 4 ft.  $\times$  4 ft. (about 2,720 plants per acre), and 4 ft.  $\times$  5 ft. (about 2,170 plants per acre).

The land should be marked out both ways, and the plants should be set at the intersections of the marks. In no other way can the rows be made so straight and the plants spaced so evenly in the rows with so little effort.

**64. Setting.**—The work of setting tomato plants in the field should be done with great care. The cost of growing tomato plants to a size suitable for field setting is considerable, and it is folly to waste by careless handling in the field what has been gained at so much trouble and expense in the frames.

The work of getting the plants to the field in good condition is much simplified if they have been grown in flats or in pots, because they need not then be taken from the soil in which they were grown until just before they are set in the ground. Plants that have been grown in the soil of the frames, however, must have special attention. They should be well watered two or three times shortly before they are removed to the field. This will make the soil moist and cause it to stick together. The plants should then be taken up by loosening the ground underneath them with a spade or knife, and as much earth as possible lifted with them. Preferably six or more plants should be lifted together. All the plants, with the earth sticking to their roots, should be placed in flats without separating them.

In the field it should be the business of one or two men to separate the plants and lay them gently at the intersections of the cross marks in advance of the setters. The plants can

usually be best separated by cutting the dirt between them with a knife, leaving as much earth as possible with each plant. They should not be dropped on the ground so that the earth will fall away from them.



FIG. 9

**65.** A tomato plant should be set at the same depth in the field that it grew in the hotbed. Potted plants with a large ball of earth about their roots should be handled carefully so

that the stem will not be broken nor the earth broken away from the roots. A hole several inches in diameter should be dug out with a trowel. The plant should be picked up sideways with the stem between the thumb and forefinger and the fingers supporting the ball of earth about the roots, as shown in Fig. 9 (a). A flat-grown tomato plant that does not have a ball of earth around the roots is commonly picked up by the stem and set in the ground as shown in Fig. 9 (b).

Immediately after setting a tomato plant, a paper collar, like that shown later in Fig. 13, should be placed around the stem of the plant if the ground is infested with cutworms.

If the weather is dry, some water should be poured about the root of each plant shortly after it is set, and, as soon as the water has soaked away in the ground, some loose earth should be thrown over the wet spot to prevent a loss of the water and caking and cracking of the moistened soil; as much as 1 gallon of water can be applied to each plant with good results, but the quantity applied is necessarily greatly dependent on the cost of getting water to the field. A good irrigation shortly after the plants are set is a great advantage.

**66.** The usual implements for transplanting are used for setting tomatoes. Most market gardeners prefer to set the plants by hand, but many also use the transplanting machines. Most of the tomatoes grown for the canning factories are set by hand. The machines used for transplanting sweet potatoes, cabbage, etc., are suitable for transplanting tomato seedlings.

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## CULTIVATION

**67.** Clean, moderately deep tillage should begin immediately after the plants have been set and should be repeated at frequent intervals until the vines become so large that they would be damaged by passing between them. Large fruits and heavy yields are dependent on proper cultivation. Cultivation will enable the soil to warm up quickly, will conserve the moisture, prevent weed growth, and allow air to penetrate into the soil. More care must be taken in the cultivation of tomatoes

than that of many other vegetables, perhaps because the roots of the plant seem unable to search out and obtain as much plant-food as the roots of many other crops under similar conditions.

Certain points should always be borne in mind in the cultivation of tomatoes. Although thorough cultivation is necessary, the plants should never be injured or disturbed in any way, for this will tend to check an early maturity and may lessen the yield. The first few cultivations that is, those given during the first week or 10 days, should be deep, in order to loosen up the soil that must necessarily be trampled somewhat during the setting. The later cultivations should be made more shallow so as not to injure the roots.

The soil about the plants should be trampled as little as possible, because this will injure the friable texture of the soil so important to the welfare of the tomato plant. This should be avoided, particularly in a clay soil, which will compact easily. In some heavy soils an excessive number of cultivations should not be made, because of the unavoidable trampling of the soil and the difficulty of cultivating deep late in the season. In a home garden, a hand hoeing of the ground around the plants may be given each night to advantage.

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### FERTILIZATION

68. The proper fertilization of tomatoes on any particular farm can be determined only after some experiment. The quantities of manure and fertilizers suggested for application in the following paragraphs are for use only until experience has shown the proper quantities of each of the plant-food constituents to apply.

As previously mentioned, the bulk of the manure and fertilizer for tomatoes is applied before or at the time the plants are set. Fresh stable manure should not be applied to the soil immediately before the plants are set, because this will tend to make the fruit mature later than it otherwise would. If fresh manure is applied to a soil intended for tomatoes it should be

applied the previous year to some other crop. An application of 15 to 20 tons per acre of well-rotted horse manure or cattle manure will be found to give excellent results; this is sometimes applied before the ground is plowed and is then turned under; sometimes it is applied after the ground is plowed and is then harrowed in. If stable manure is not available, some green-manure crop should be plowed under.

If the soil is not fairly rich, a forkful of well-rotted manure spaded into the soil under each hill, in addition to that applied broadcast, will give the plant an early start; if fresh manure is forked into a hill it will delay maturity and do more harm than good. Few commercial growers feel that they can afford the labor necessary for this work, but on a small scale it is usually satisfactory.

Well-rotted stable manure will be particularly beneficial on thin and leachy soils, because it will increase the water-holding capacity of the soil as well as furnish plant-food.

On fertile soils, and especially those that have received a liberal application of manure, about 1,000 pounds of a 2-8-8 commercial fertilizer per acre will be found ample for the needs of the crop. The usual practice is to broadcast about 600 pounds of this fertilizer over the ground previous to the final smoothing harrowing, and then to scatter the other 400 pounds about the plants after they are set and to hoe it in. If much less manure than that recommended is applied, a fertilizer containing about 4 per cent. of nitrogen should be used.

**69.** The best results in tomato fertilization are secured only when a proper balance between vine growth and fruit production has been maintained. The late Professor Voorhees estimated that a crop of 10 tons of tomatoes, and the 4 tons of vines that would be required to produce them, would contain about 57 pounds of nitrogen, 16 pounds of phosphoric acid, and 94 pounds of potash. Hence, at least this much plant-food should be applied per acre, with a liberal quantity for good measure. As previously mentioned, an application of about 1,000 pounds of a 4-8-10 fertilizer will provide ample plant-food and has been found satisfactory by many growers.

As a general thing, a soil that has been made rich by systematic, intelligent fertilization over a long period of years will be much more satisfactory than a soil on which an attempt has been made to make up for previous deficiencies by applying an immense quantity of fertilizer all in one year. There is a mistaken idea in some sections that tomatoes should not be planted in rich soil. In fact, they do best in soil that has been enriched in the manner just described.

Careful experiments have shown that the best effects are sometimes produced by the liberal use of one fertilizer constituent, and sometimes by another. In the trucking sections of New Jersey, the best results were found to be produced by a liberal use of nitrogen; in New York, Ohio, and parts of the West, on stronger soils, the yield of first-grade fruit was found to be actually lessened by too much nitrogen. In several parts of the South, the best results, both in quality and quantity, have been secured by a liberal application of phosphates; in other sections, a large quantity has been found of little value or actually harmful. Sometimes, liberal applications of potash will prove especially beneficial.

The use of extra-large quantities of any one of the fertilizer constituents, nitrogen, phosphoric acid, and potash, should never be attempted until after its value has been demonstrated by experiment. The quantities to apply should be varied according to the condition of the soil. Large applications of one of these constituents are beneficial only when the soil is deficient in that constituent. Improperly applied, an excess of nitrogen will produce a rank growth of vine and soft, watery fruit; an excess of phosphoric acid will tend to produce soft fruit of a weak acid flavor; and an excess of potash will produce a small growth of vine and firm but excessively acid fruit.

**70.** Nitrogen produces the most pronounced effects on tomatoes, and much of the success in growing tomatoes depends on how liberally this fertilizer ingredient is applied and when and how it is applied. Nitrogen in the form of nitrate of soda is of most value early in the season before the organic nitrogen in the humus matter in the soil becomes available.

Two or three fractional applications of 150 to 200 pounds of nitrate of soda per acre early in the season will stimulate a vigorous vine growth before the fruits begin to turn red, and in most cases will result in a greatly increased yield. Part if not all of the nitrogen applied in the fertilizer that is broadcasted should be in an organic form, as dried blood, tankage, fish scrap, etc. The application of large quantities of nitrogen, however, should always be made with caution. Large quantities of soluble nitrogen applied late in the season, especially in soils deficient in phosphoric acid and potash, will always result in a heavy growth of vine and foliage at the expense of the fruit. An application of fresh stable manure to the soil immediately before the plants are set will also usually have the same effect. The best results with readily available nitrogen are obtained on the early crop of tomatoes. The late crop will not require so much.

It is also important to make suitable applications of phosphoric acid and potash. Without sufficient of these, the fruit will be small and of poor quality and the crop will usually be light.

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### TRAINING OF TOMATO PLANTS

**71.** The training of tomato plants on supports of some kind has become a common practice in many localities, although only a very small percentage of the total tomato crop is so grown. Training includes the tying up of the vines on stakes, trellises, or forms.

**72.** By far the larger part of the commercial tomato crop that is trained is grown on stakes as shown in Fig. 10. This method of supporting them requires the minimum quantity of lumber and the least work in placing the supports, and leaves passageways in all directions through the field. The stakes are commonly made from 1 inch to  $1\frac{1}{2}$  inches thick and from 5 to 7 feet tall. Stakes that are split, although not of an attractive appearance, are much stronger than those that are sawed, and are much preferred on this account. Stakes made of young

saplings are also satisfactory. The tomato stems are tied to the stakes by means of raffia or soft string; care should be taken not to cut them when this is done.

**73.** A small part of the commercial tomato crop that is trained is grown on a two-pole trellis like that shown in Fig. 11. The posts that are sunk in the ground may be of any convenient



FIG. 10

diameter and long enough so that they will stand from  $4\frac{1}{2}$  to 5 feet out of the ground. The trellis crosspieces can be of any diameter from about  $1\frac{1}{2}$  inches square up, although, if the lumber has to be purchased, the smallest size suitable will be the most economical; lengths of 12, 14, or 16 feet are suitable. A trellis will cost about 50 per cent. more than stakes, will be no more satisfactory, and will close passageways on the field except in the direction of the rows.

**74.** The form shown in Fig. 12 is sometimes used when tomato plants are grown in the home garden, but they are too expensive and too inconvenient to handle for the average commercial grower who plants

even only a small acreage. This frame may be made out of any light wooden strips; one is placed about each tomato plant. Wire frames of similar construction may be easily made; they may also be purchased ready made on the market.

75. In the greenhouse, tomatoes are nearly always trained on a trellis made of wire or string or on single strands of wire or string. These are commonly supported from the framework of the house above and tied to short stakes driven in the ground.

76. The advantages claimed for training tomatoes are: (1) The fruit will ripen somewhat earlier than it would if the vines were not trained, because the fruit is held up off of the ground where the sun can get at it better and where there is a

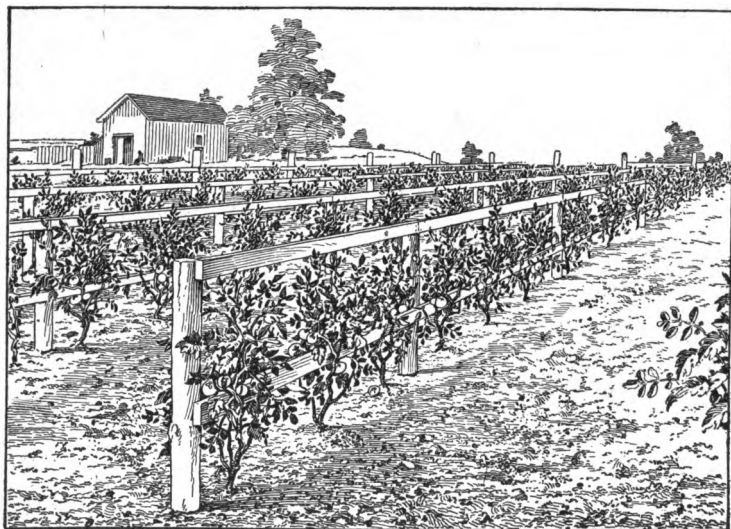


FIG. 11

good circulation of air; (2) the quality of the fruit is somewhat improved by its being grown at an elevation from the ground, the improvement being principally in appearance because of the freedom from blemishes that are commonly received when the fruit is in contact with the ground; (3) the tomatoes are easier to harvest; (4) varieties which will not thrive well under ordinary field conditions but which will produce a fancy fruit when properly handled will give the best results in the field when trained; (5) on account of the freer circulation of air and the consequently small quantity of moisture on the

vines, less trouble is experienced with fungous diseases than when the vines lie close to the ground; (6) because the vines are up out of the way, spraying and cultivation can be continued longer; (7) the fruit will be free from dirt when picked and the cost of cleaning it for market is done away with; (8) because of the earlier maturity, the time saved may be utilized in growing a second crop on the ground in the same season.

77. The results obtained from staked, or supported, tomatoes have been somewhat contradictory. Some practical grow-

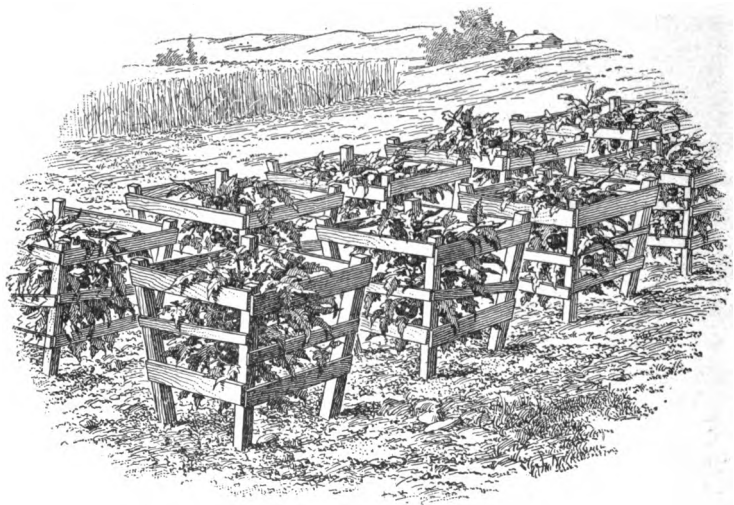


FIG. 12

ers and some state experiment stations claim that they can obtain the highest yields of marketable fruits by staking, but other experiments at state experiment stations have demonstrated the reverse to be true, and many practical growers do not favor the practice because of the following disadvantages: (1) The yield from the staked vines is not larger than from vines on the ground and is often somewhat less; (2) the cost of stakes and the expense of staking is considerable; (3) more plants are needed to set an acre; and (4) the pruning and tying up of the vines involves considerable labor.

**78.** When grown on stakes, tomato vines are pruned to one, two, or three stems, but in some cases they are not pruned at all; pruning to one stem is most largely practiced by those using stakes, although, as discussed elsewhere, the lowest yields have been produced by this method.

**79.** Tomatoes are trained to a single stem by pinching out all the side branches which start from the axils of the lower leaves. This throws all the growth of the plant into the main stalk. When the plant has reached a height of about 15 inches it should be tied loosely to the stake, and, as growth progresses, should be tied every 10 or 15 inches above that. Each tie should be made just below a leaf branch so that the plant will be held from slipping and twisting. A plant thus handled should develop clusters of fruit every 8 to 12 inches, and the first cluster should not be more than 12 inches from the ground. Varietal differences enter into this somewhat, however; certain varieties are much heavier yielders than others. When the tomato vine has reached a height of about 6 feet, or has reached the top of the stake, it is customary to cut off the terminal bud, or leader, and thus to force the plant to devote its energies to developing its fruit to large size as early as possible. Unfortunately, however, this continuous pruning will often tend to stimulate the vegetative growth at the expense of the fruit growth, and the yields are not found to be as heavy as when the plant is unpruned.

The pruning of the plants to two and three stems is conducted in much the same way, except that more main stems are allowed to develop. Some growers merely tie the plants up on stakes to hold the fruit up off of the ground, and do not prune them at all. The yields are always heavier on such vines, and the fruit is kept free from injury. The only question to be decided in this case is whether or not the tying up saves enough fruit from injury to pay for the cost. It is doubtful whether it will in most sandy soils.

**80.** The relative value of growing tomatoes on stakes pruned to one, two, and three stems, and unpruned, of growing them on a trellis, pruned to one, two, and three stems, and

unpruned, and of growing them on the ground pruned to one, two, and three stems, and unpruned is shown in Table I. This table shows, for each of these conditions, the yield in boxes of the different grades, fancy, second, and cull, the gross returns for each of the three grades, the total gross returns, the total cost of production, and the net profit. The information in this table is the result of 3 years of experimenting in tomato culture at the Idaho Agricultural Experiment Station, under the direction of Prof. W. H. Hicks, and is in accord with results obtained at a number of other prominent state experiment stations.

In compiling this table, only the marketable fruit produced by the tomato plants was considered; that is, only those fruits that could be sold as culls, or better, were included. The work was done in small plats and the results reduced to an acre basis by figuring 2,722 plants per acre, because the plants were set 4 ft.  $\times$  4 ft. in the plats. The total gross returns are determined for each grade according to the average price received per box, which was 55 cents for fancy, 40 cents for seconds, and 20 cents for culls. The total gross returns are determined by adding together the amounts received for all three grades. In determining the total cost of production per acre, all expenses incurred during the year for each method of growing were added together. The figures on the net profit per acre were secured by subtracting the total cost of production from the total gross returns. Although the net profit figures are purely an estimate on the acre basis, yet they are based on facts and figures secured for each plat during the experiment, and are therefore reasonably authentic.

81. The statistics in Table I indicate that the highest net profit may be expected from tomato plants which receive no pruning and no training. The fact is, however, that the tomato plants which received no pruning, but which were trained on the trellis, produced more boxes of all grades than the plants handled in any other way, although the cost of the trellis material lowered the net profit per acre. This table also shows that in every case the yield and net profit per acre are the smallest when the plants are pruned to one stem, and that the yield and

TABLE I

TABLE OF YIELD, GROSS RETURNS, COST OF PRODUCTION, AND NET PROFIT FROM 1 ACRE OF TOMATOES UNDER DIFFERENT METHODS OF PRUNING AND TRAINING

	Yield in Boxes			Gross Returns			Total Gross Returns	Total Cost of Production	Profit Net
	Fancy	Seconds	Culls	Fancy	Seconds	Culls			
Pruned to one stem, on stake.....	216.39	187.81	205.51	\$119.01	\$ 75.12	\$41.10	\$235.23	\$128.56	\$ 96.67
Pruned to two stems, on stake.....	307.58	186.45	250.42	169.17	74.58	50.08	293.83	144.14	149.69
Pruned to three stems on stake.....	326.64	178.29	273.56	179.65	71.32	54.71	305.68	144.83	160.85
No pruning, on stake.....	423.27	288.53	398.77	232.80	115.41	79.85	427.96	113.85	314.11
Pruned to one stem, on trellis.....	236.81	191.90	164.68	130.25	76.76	32.94	239.95	166.66	73.29
Pruned to two stems, on trellis.....	322.55	224.56	223.20	177.40	89.82	44.64	311.86	174.53	137.33
Pruned to three stems, on trellis.....	375.63	236.81	230.00	206.60	94.72	46.00	347.32	178.55	168.77
No pruning, on trellis.....	503.57	347.05	434.05	276.96	138.82	86.83	502.61	191.90	310.71
Pruned to one stem, on ground.....	186.45	216.39	171.48	102.55	86.56	34.30	223.41	92.62	130.79
Pruned to two stems, on ground.....	254.00	232.73	203.65	139.70	93.09	40.70	273.52	97.96	175.56
Pruned to three stems, on ground.....	259.95	204.15	259.44	142.97	81.66	51.89	276.52	96.73	179.79
No pruning, on ground.....	427.35	344.33	424.63	235.04	137.73	84.93	457.70	114.07	343.63

net profit per acre increase, regardless of the method of training, when pruning is not performed.

82. The growers who secure the greatest net returns from staking tomatoes or growing them on trellises in the field are usually those few who grow tomatoes under glass as part of their business. Under glass, of course, the crop is grown during the part of the year when the crop cannot be grown outdoors, but local growers who grow the crop under glass must develop a market for fancy, high-priced tomatoes if they are to succeed. Customers that have come to appreciate tomatoes of high quality and appearance will be dissatisfied with the ordinary run of the outdoor crop, and hence growers supplying such a trade find the staked tomatoes of much value in following up their greenhouse tomatoes with their fancy trade during the summer. It has even been found to be profitable to continue selling high-grade staked tomatoes by the fancy package and by the pound long after the ordinary outdoor-grown tomatoes are selling for 60 cents to \$1 a bushel. In some local markets, the price for such fruit has averaged from three to six times as much as for the fruit from the ordinary field-grown tomatoes. All growers, however, cannot expect to secure such a trade; it can be developed only after years of preparation when a reputation for honest goods, honestly packed, has been built up.

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### IRRIGATION

83. The irrigation of tomatoes will vary with soil and climatic conditions. In arid regions, irrigation is naturally essential, but even in humid climates irrigation will, in many cases, produce marked results.

In sections where irrigation is a regular practice, and is essential because of the deficiency or absence of rainfall, the following method of irrigating is usually followed: As soon as the plants have been set, water should be applied in sufficient quantity to wet the soil to a depth of several inches, so that the plants will get a good start. Then cultivation should be at once begun and persisted in with the purpose of preventing the evaporation

of water and lessening the number of irrigations, which are necessarily expensive. Usually not more than three irrigations after the first one are considered necessary, but this point must be determined by the condition of the plants during growth. The best results cannot be secured if the plants do not have an ample supply of water.

As a rule, more water will be required by the plants when the fruit begins to fill out and mature than previous to this time. If possible, a heavy irrigation should be timed to come just before this stage of development.

In irrigated regions, it has been found profitable on a commercial scale to place a forkful of well-rotted horse manure under each hill of tomatoes. This has sometimes been the means of saving an entire crop, has uniformly increased the yield of fruit, and has lessened the damage from fungous diseases. These benefits are largely due to the water-holding qualities of the manure, which prevent checks in growth due to a sudden deficiency in the water supply.

In humid regions, many market gardeners and truckers find that irrigation will increase the tomato yield. Overhead irrigation has been found to be particularly efficient, because by this means the water can be applied quickly and easily when needed. An abundance of water in a humid section means immunity from injury from the dry spells, that frequently occur during the late spring or early summer.

## INSECT PESTS AND INJURIES

### INSECT PESTS

84. The tomato, like most extensively-grown crops, is subject to the attack of many insect pests. Important among these are the following general crop pests: *Cutworms*, *flea beetles*, and *blister beetles*. The most important of the special insects attacking this crop are two *tomato worms*, or *horn worms*, the *stalk borer*, and the *tomato fruit worm*.

85. The **cutworms** are a very serious enemy of the tomato. One worm will often cut off two or three plants in a night. In some seasons, over half of the plants in large fields have been destroyed by cutworms during the first week after they have been set. The cutworms have been previously described in detail.

In the great majority of fields, it is decidedly unsafe to set tomato plants without taking precautions against cutworms. If fall plowing has not been done, and sometimes even when it has been done, further attention is essential. A poisoned bait of clover leaves or bran soaked in a solution of Paris green may be used; this is scattered closely about the plants, so that the cutworms will be tempted to eat it before the stems. A paper collar is sometimes placed about the stem of each plant in addition to this; in other cases, the collar is used without the poisoned bait. A young tomato plant with a paper collar in place is shown in Fig. 13. Common brown wrapping paper will do for this purpose. The collar should extend from  $\frac{1}{2}$  to 1 inch below the surface of the ground and about 2 inches above ground. Such a paper collar is usually a satisfactory protection against injury from cutworms. The paper should be cut to a convenient size, about 3 inches by  $3\frac{1}{2}$  or 4 inches, in advance of

the time of application, so that the collars can be quickly applied when there is any danger of an attack from cutworms. Some growers make a practice of applying paper collars to all plants as they are set in the field. Although these collars are usually satisfactory, the cutworms will sometimes climb over them and cut the stem of a young plant off even with the top of the collar. No method of preventing such damage is known.

86. The **flea beetles** seem to enjoy tomato leaves about as well as potato leaves. The best preventive is to spray with Bordeaux mixture (5 pounds of copper sulphate, 6 pounds of



FIG. 13

stone lime, water slaked, and 50 gallons of water); Bordeaux mixture is not poisonous to flea beetles but it seems to repel the insects. Flea beetles, however, are one of the least important insect pests of the tomato, and spraying is seldom necessary to check them. On vigorous plants on land that is well prepared and well cultivated, they seldom, if ever, do enough damage to check the growth.

87. The **blister beetles** are troublesome in some localities, but they are easily controlled by spraying with a poison for the other insect pests.

88. The **Colorado potato beetle**, commonly known as the *potato bug*, will attack and feed on tomatoes about as readily as on potato vines. Any stomach poison, such as arsenate of lead and Paris green, will kill this pest as rapidly as it gets on the vines and prevent it from doing any serious injury; on account of the less liability of injuring the foliage, however, arsenate of lead is to be preferred to Paris green.

A most economical and effective method of controlling the Colorado potato beetle, the flea beetles, and the blister beetles is to spray the plants thoroughly, while they are still in the frames and before they are transplanted in the field, with 5-6-50 Bordeaux mixture to which has been added 2 pounds of arsenate-of-lead paste. This spray should be applied a day or two before the plants are to be set in the field and they should be allowed to dry thoroughly before transplanting time.

89. The two **tomato worms**, which are the same as the *horn worms*, or *tobacco worms*, that attack tobacco, are large and green and so very similar in appearance that they are not commonly distinguished from each other. Both are voracious leaf eaters and seem to be becoming more abundant. If they are allowed to feed uninterruptedly, they will defoliate large portions of a plant and will even destroy considerable fruit.

On a large area, the most satisfactory method of control is to spray the vines with a stomach poison as soon as the insects appear. A 5-6-50 Bordeaux mixture with 2 pounds of arsenate of lead paste added is effective. In the South, many growers allow turkeys to roam about in the tomato fields, and these birds eat immense quantities of the tomato worms. On a small scale, hand picking may be practiced, but this is seldom satisfactory, because it is often difficult to find the worms until after they have done considerable damage.

The tomato worms are themselves attacked by parasites, which kill large numbers. The tomato worms will often be seen carrying a large number of what seem to be small white eggs on their backs. These, however, are not eggs, but little silken cocoons of a small, wasplike parasite. The larvas of this insect feed internally on the juices of the tomato worms before

becoming transformed into the pupal stage and kill the worms in this way. Such insects should obviously never be destroyed. The tomato worms are also at times attacked by a bacterial disease that causes them to turn dark and become shriveled.

**90.** The **tomato stalk borer** sometimes attacks tomato plants and inflicts serious injury. This insect is the same as the *potato stalk borer*. The larvas usually feed first on the leaves and then work their way down the leaf stalks and penetrate the stalks, where they tunnel and eat out the greater part of the heart. Their presence is often first detected by the sudden wilting of the parts of the plant directly above where they are at work.

Part of the work of controlling the tomato stalk borer should be preventive. Cultivation should be clean, because the insect also feeds on weeds, and ragweed and burdock are its principal food plants; all weeds should be destroyed. A proper rotation, that is, one in which tomatoes are not grown on the land more often than once in 3 or 4 years will aid in controlling this pest. In small gardens, the prompt destruction of infected plants will usually prevent the spread of the pest to other plants. Systematic spraying with a stomach poison such as arsenate of lead, as recommended for the other insect pests, will be effective in killing the tomato stalk borer provided it is applied before the larvas enter the stems of the plants.

**91.** The **tomato fruit worm** is a worm that commonly bores into the green and ripening tomatoes. It is also called the *cotton boll worm*, the *tobacco bud worm*, and the *corn-ear worm*, according to the plant attacked. This worm is frequently very troublesome to tomato growers. It will feed on the leaves to some extent, but it does the most damage to the fruit, which it quickly renders unmarketable.

The practice of proper cultural methods will do much toward controlling this insect. Fall plowing is particularly effective. Land that was planted the previous year to cotton or corn infested with this insect should never be planted to tomatoes unless it has been plowed deep and thoroughly harrowed during the winter. In localities where the pest is abundant, it is

well to plant tomatoes at a considerable distance from corn and cotton fields. A row or two of corn planted around a tomato field will act as trap plants and by attracting the insects will diminish the number that attack the tomatoes. As the insects feed on the foliage to a certain extent before they attack and bore into the fruit, many may be killed by spraying with an arsenate-of-lead spray mixture as previously recommended for the other insect pests of tomatoes. Two or three applications of the poison will be necessary to protect the vines if the insects are abundant. If it is necessary to spray for this pest within a week or 10 days before the fruits begin to ripen, Paris green (1 pound of Paris green to 50 gallons of water) will be a better insecticide to use, because it will wash off more quickly than arsenate of lead and will not stain the fruit. This poison should not, however, be sprayed on the fruit within 2 weeks of the time of marketing, because of possible injury to the consumers.

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## DISEASES

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### PHYSIOLOGICAL DISEASES

92. The tomato is subject to more than a dozen ills, some of which are caused by a lack of the proper conditions of growth and some by parasites, which injure the leaves, fruit, stems, and roots. The former are known as **physiological diseases**; the latter, as **parasitic diseases** or as *fungous diseases* and *bacterial diseases*, according to the organism causing them.

It is generally true that the health of a tomato plant is largely dependent on the conditions under which it is grown. The more conducive these conditions are to a natural, healthy development of the plant, the less subject will it be to ills of any kind, and the less seriously will it be affected by fungous diseases when it is attacked.

93. The tomato plant is naturally tender, and is not so able to adapt itself to untoward conditions as are many of the more hardy vegetables. Hence, when the plants are subjected

to too much or too little bright sunshine, to unfavorable atmospheric conditions, to an inadequate or excessive moisture supply in the soil, or are supplied with poorly-balanced plant-food, the result is almost invariably an abnormal development in some direction.

**94. The shedding of the blossoms** is one of the most common of the abnormalities caused by unfavorable surroundings, and is often very noticeable. The plant will grow a cluster of blossoms which should normally develop fruit. Instead, however, these blossoms hang on for only a few days and then drop off at the joint. This will sometimes happen before the blossoms open.

This abnormality may be caused by the application of too much fresh stable manure, which has furnished too abundant a supply of nitrogen and kept up a fermentation in the soil. More often, however, it is likely to be caused by a sudden change in temperature or by a lack of sunlight due to an extended period of cloudy, wet weather.

**95. Fruit cracking** is often a troublesome occurrence on tomatoes and is usually caused by an uneven growth of the plant. There are a number of factors that might contribute to an uneven growth, but the principal one is an irregular water supply. Cracked tomatoes often appear immediately after a rain following a long spell of dry weather. Thorough, deep cultivation and deep rooting of the plants will do much to furnish a uniform water supply to the plants and hence to limit the damage from fruit cracking.

**96. Leaf curl**, or *blistering* is frequently seen on the leaves of plants in highly-fertilized soil and that have been trained to stakes and pruned. The leaves grow a very dark green, and the curling, or blistering, makes them look abnormal. This condition is caused by an attempt of the plant to adjust an unbalanced condition of the root system and leaf growth due to pruning. When only a few leaves are badly affected, or many leaves are only slightly affected, this abnormal condition seems to do no damage to the plant. But when the abnormal

condition becomes very marked the leaves are unable to carry on their functions properly, and the plant is as bad off as if it were attacked by some serious specific disease. The method of preventing damage from this cause is very evidently to avoid the conditions that induce it.

**97.** A derangement known as **Mosaic disease** frequently affects tomatoes and sometimes may spoil an entire crop. The characteristic indication of this trouble is a variegated appearance of the leaf, some portions showing light-green and other portions dark-green patches. The cause of this derangement is not definitely known; probably unsuitable conditions, such as an improper food supply, unfavorable soil conditions, or severe injury to the root system during transplanting, are responsible. When grown under good management, tomato plants seldom if ever exhibit this abnormality.

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#### PARASITIC DISEASES

**98.** The parasitic diseases of tomatoes are principally fungous diseases, although, in the case of blossom-end rot, certain bacteria are always present. These diseases attack different parts of the plant, such as the leaves, fruit, stem, and root. Fortunately, for the tomato grower, all of the diseases of tomatoes are not prevalent over a wide territory.

**99. Diseases of the Leaves.**—The principal parasitic diseases of tomato leaves are *leaf spot*, *leaf mold*, and *downy mildew*.

**100. Leaf spot**, illustrated in Fig. 14, is prevalent over a wide range of territory. It may be caused by one of three fungi, although the result of the fungous growth is the same in each case. One of the fungi causing the leaf spot on the tomato is identical with that which causes the early blight of the white potato. The fungi causing leaf spot characteristically attack the older leaves on the plant first. They form round, dark-brown spots, which are at first small but which gradually increase in size until the whole leaf dies. The leaf-

spot disease affects varieties of the first-early class more severely than the later kinds and often cuts their season in half.

**101. Leaf mold** affects the under side of the leaves first and makes this side assume a velvety, greenish-brown appearance. As the disease progresses, the leaves attacked turn yellow and drop off. This disease attacks tomatoes in the field only in the extreme Southern States, but frequently occurs on greenhouse tomatoes in all sections.

**102. Downy mildew** of tomatoes occurs during very moist, cool weather, and cannot develop during hot, dry weather. This disease is caused by the same fungus that causes the late blight of white potatoes. It is said to be injurious only in New England and on the winter crop of tomatoes in Southern California.

**103.** The leaf spot, leaf mold, and downy mildew of tomatoes may be controlled by thorough and frequent spraying with Bordeaux mixture. The first spraying should occur a day or two before the plants are moved from the frames where they are grown for transplanting, and sprayings should be given in the field at intervals of 10 days to 2 weeks until the first fruits begin to ripen. Sometimes tomatoes that are not sprayed in this way will not be affected, but no reliance can be placed in a crop unless it is well sprayed. When grown under especially favorable conditions, as on many market gardens, the natural vigor, and health of the plants makes spraying less of a



FIG. 14

necessity. But truck farmers almost invariably find it a necessity.

The Bordeaux mixture suitable for spraying for the leaf diseases of tomatoes is represented by a 4-5-50 or a 5-6-50 formula. The first is made from 4 pounds of copper sulphate, 5 pounds of good stone lime, water slaked, and 50 gallons of water; the figures in the second formula indicate different quantities of the same materials. When insects are to be combated, 2 pounds of arsenate-of-lead paste, properly thinned with water, should be added to each 50 gallons of the Bordeaux mixture.

**104. Diseases of the Fruit.**—The principal diseases affecting the fruit of the tomato are *blossom-end rot* and *anthracnose*, or *ripe rot*.

**105. Blossom-end rot, point rot, or black rot,** of the tomato is a peculiar affection of the fruit. Tomatoes affected

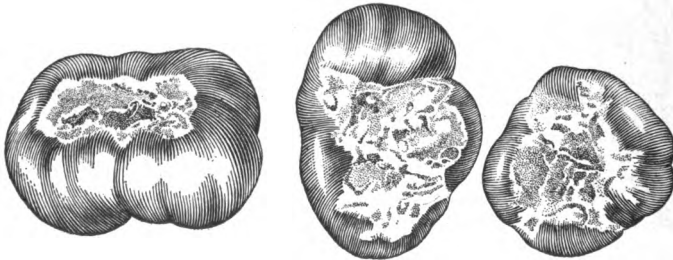


FIG. 15

with this disease are shown in Fig. 15. The cause is not definitely known, but it occurs when the vitality of the plants have been somewhat reduced by an insufficient supply of moisture. It first appears as a black, sunken spot on the blossom end of the fruit. This is usually circular in outline and makes a progressive growth in all directions. Any fruit affected must be thrown away, and the percentage of affected fruit is often large. This disease is most troublesome on land that warms up early in the spring and occurs frequently only on the early varieties. Well-managed irrigation will aid in its control as also will deep and thorough cultivation, which will insure deep

rooting of the crop and a conservation of soil moisture. Blossom-end rot often appears on half-grown green tomatoes and seems as likely to attack the unripe as the ripe specimens.

**106. Anthracnose, or ripe rot,** of the tomato produces a rapid, soft decay of the fruit and develops most rapidly during warm, moist weather. The disease attacks only the ripe fruit, either on the vine or after it is picked. The injury is characterized by sunken, discolored spots on the fruit, which is wrinkled and specked with black. No means of prevention is known.

**107. Diseases of the Stem.**—The principal diseases affecting the stem of the tomato plant are *damping off*, *bacterial wilt*, *fusarium wilt*, and *sclerotium wilt*.

**108. Damping-off** fungus is very active in the destruction of tomato seedlings, probably because the temperature at which they are grown under glass is conducive to its active growth. Plenty of sunlight and ventilation, moderate or sparse watering, and good surface tillage in the hotbed are the only known means of preventing loss from this disease.

**109. Bacterial wilt** has been referred to in the Section entitled *White Potatoes*. It is one of the most serious diseases of tomatoes and is prevalent over a large part of the United States. It does its most serious damage in the Gulf States, where many growers have found tomato growing a most uncertain occupation because of its ravages. The action and effect of the disease is almost identical with that of the bacterial wilt of the cucumber, which is described elsewhere, and the cause is the same. The bacteria enter the tomato plant either through the tissue that has been injured by leaf-eating insects or by way of the roots. They then collect in the sap-conducting tissue of the stem and multiply so rapidly that they quickly clog the passages and cause the starvation of the plant. The softer and more succulent the growth of the plant, the quicker will the injury be noticed and the sooner will the death of the plant be brought about. The first indication of the presence of the disease is a wilting of part of the foliage. If the stem of the

plant is cut at this time it will be seen to have turned brown on the inside. The entire foliage on the plant will shortly wilt, and death will soon follow.

Only preventive measures are of value in avoiding loss from this disease. Rotation is the chief of these; soil once infected with the bacteria should not be used again for this crop for at least 3 or 4 years. The destruction of the plants first affected by the disease will prevent the spread of the disease. Its progress in the soil is comparatively slow. The prevention of the mutilation of the leaves by practicing the proper methods of control against the insect pests of the tomato will remove the possibility of the bacteria entering the plant through injured parts of the leaves.

**110. Fusarium wilt** of the tomato is a disease of considerable importance in Southern Florida and in Southern California. A plant attacked by this fungus wilts and dies in a manner so similar to one affected with bacterial wilt that it is difficult for the inexperienced person to distinguish between the two. The cause of fusarium wilt is entirely distinct from the cause of bacterial wilt. The former comes entirely from the soil and is a distinct fungus not known to attack any other garden crop.

A rotation in which tomatoes are not grown on the same land oftener than once in 3 years has been found effective in preventing loss from this disease in infected regions.

**111. Sclerotium wilt** of the tomato is another very similar disease to the bacterial wilt and fusarium wilt, but is caused by a different fungus. It attacks the plant near the ground, works its way into the stem, and gradually cuts off the food and water supply of the plant.

Rotation, as for the two wilts previously described, will prevent loss from this disease.

**112. Diseases of the Roots.**—The principal diseases affecting the roots of the tomato are *root knot* and *rosette*.

**113. Root knot**, or *nematode*, is a disease of the tomato root that is more frequent and serious than rosette. It appears

to be troublesome only in light, warm soils. The cause of the disease is a thread-like worm, which attacks the roots and produces a growth of little protuberances, or knots. These growths interfere with the normal functions of the roots, and, if they become very numerous, will seriously injure the productivity of the plant.

Rotation in the field, that is, growing tomatoes and its other host plants not more often than once in 3 or 4 years, is the only means of avoiding damage from this disease. The same parasite attacks cotton, cowpeas, melons, okra, and some other closely related plants, and these crops should be avoided in a rotation.

**114. Rosette** of the tomato is caused by a fungus that attacks the roots and stem near the ground surface; this fungus appears to be the same as that causing rosette on the white potato. When attacked by this fungus, a tomato plant is dwarfed, the leaves become curled, and the crop-producing power of the plant is greatly reduced.

A proper rotation of crops and heavy liming are the only advisable means of control.

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## HARVESTING, STORAGE, AND MARKETING

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### HARVESTING

**115. Picking.**—The time for starting the picking of tomatoes will naturally vary somewhat with the season. In the latitude of New York City, the fruit of early varieties that have been set in the field about May 15, if the crop has been well cultivated, should begin to color from July 5 to July 15, and a good yield of fruit should be obtained shortly after that. The picking should continue for from 6 to 10 weeks. Sometimes disease will interfere and stop growth prematurely, or, if the early yield of fruit has been heavy, the vitality of the plant may be reduced to such an extent that the picking season will not last so long; sometimes a tomato plant will throw out new

roots from the branches and continue its growth, but the commercial grower will seldom have time to take advantage of such a second growth.

In the latitude of New York City, late varieties will not begin to yield until late in July, and, if properly handled, should continue to grow vigorously and produce fruit until cut down by frost in the fall. The maturity of the fruit will occur earlier or later in different localities, according to the latitude.

The intensive market grower usually limits his tomato crop to the early varieties and when the market price has declined to such an extent that there is little profit left, he cleans the vines out of the field and plants some fall vegetable crop, or seeds the ground down to a cover crop.

**116.** The stage at which tomatoes should be picked depends on the distance from market, and on the weather conditions, such as the danger from a frost. The market gardener usually picks his tomatoes when they are nearly ripe, but the grower at a distance from market must pick them much sooner. In the South, tomatoes are usually picked for shipment to Northern markets as soon as they begin to turn pink. At this stage tomatoes are always of inferior quality, because the fruit does not secure its full flavor unless it is allowed to ripen on the vine. All tomatoes for a local market are not allowed to become fully ripe, however. Those intended for packing in the bottom of the packages should be picked while still firm so they will stand transportation better and will keep longer; this is an important detail in packing, and if overlooked will prove often costly.

The stage for picking should be carefully studied by each grower, in order that he may get his product to the consumer in a firm, solid condition. In most markets this is of more importance than having the fruits of the finest flavor. It is often difficult to get tomatoes to the consumer in a firm condition in midsummer, because they lose their firmness quickly in hot weather. A touch of frost will also injure the firmness of the fruit, and all tomatoes should be picked before they are liable to be frosted. As explained later, green tomatoes can be ripened fairly well in storage.

**117.** In the work of picking tomatoes, every effort should be made to avoid bruising the fruits, because any bruising will result in more or less deterioration; badly bruised fruits will often spoil enough to be unsalable before they can be gotten to market. The picking may be done by boys, but in this case the baskets used should be small. Tomatoes are heavy, and a large basketful will not only be too heavy for a boy to carry, but the tomatoes will be likely to be handled too roughly when a boy attempts to carry more and empty out more than he can conveniently manage.

Tomatoes should be picked by gently taking hold of the fruit and turning it back on the stem until the joint in the fruit stem, about  $\frac{1}{2}$  inch from the fruit, will snap, and leave the stub of the stem attached to the fruit. Many growers require pickers to push the stub of the stem off of the fruit before placing it in the basket, because, in placing one tomato on top of another, the stem is almost sure to puncture some of the fruit and make it unmarketable. This is important with fancy staked tomatoes. With the ordinary field-run tomatoes, little attention is paid to this point.

To prevent as much bruising as possible, tomatoes should be transported from the field to the packing shed in spring wagons.

**118. Yields.**—A good yield of tomatoes is about 500 bushels per acre. With the competition that exists in market gardening, no grower can expect to obtain a satisfactory profit unless he can produce about that much; truck farmers can produce less more profitably. Often yields will not exceed 200 bushels per acre, and the cost of production will be fully as great as for a 500-bushel crop. Under proper management, single tomato plants have been made to yield as much as  $\frac{1}{2}$  bushel of ripe fruit, and it is practicable for skilful growers to secure yields of 800 to 1,000 bushels of tomatoes to the acre. The yields in boxes per acre under different systems of culture are shown in Table I.

**119. Preparation for Market.**—When tomatoes are to be sold in fancy packages to a high-class trade, the first step in preparing them for market is usually to wipe off all dirt with a

cloth and then possibly to remove any stems that may have been left by the pickers. Comparatively few tomatoes, however,



FIG. 16

are cleaned in this way. When grown on a sandy soil, little cleaning should be necessary.

For the best trade, tomatoes should be carefully sorted and graded. Those, placed in the best, or fancy, grade should be of uniform size, without blemish, and of an attractive, even color. All cracked fruits, all those with punctured skins, and

all that have rough skins, or that are undersized, should be placed in the second grade. The carefulness exercised in grading naturally depends largely on the trade catered to.

Many packages are used for tomatoes. In the New England States, the common so-called bushel box, measuring 18 in.  $\times$  18 in.  $\times$  8 in., is used. In the Middle West and also in many other localities, the bushel basket shown in Fig. 16, is used. Most of the tomatoes sent into the large New York and Philadelphia markets from near-by growers are shipped in the common  $\frac{1}{2}$ -bushel and  $\frac{5}{8}$ -bushel peach baskets. Tomatoes intended

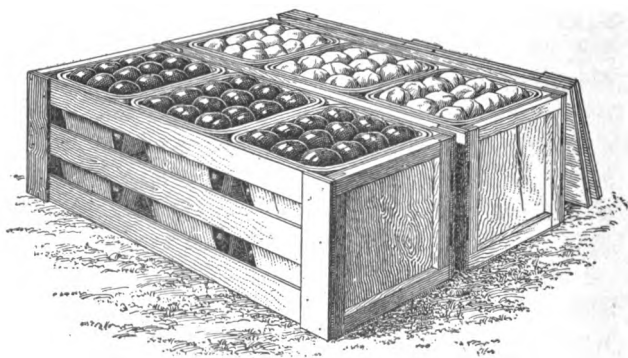


FIG. 17

for long shipment, such as those from Florida and other Southern points, are packed in the tomato carrier shown in Fig. 17;

this contains six small cartons, or baskets, in which the fruits are packed in regular rows, usually four one way and three the

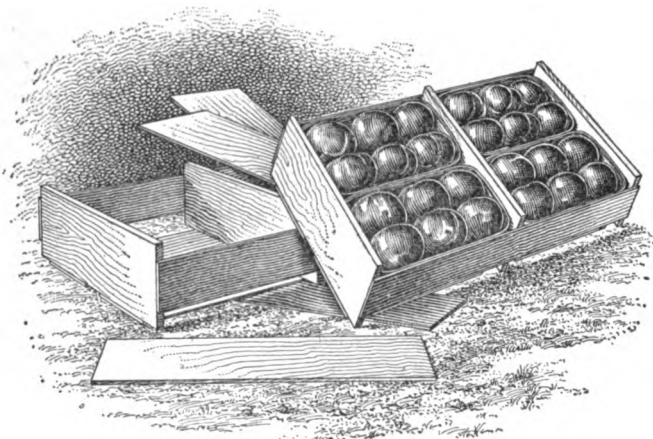


FIG. 18

other; sometimes the tomatoes are wrapped in paper. Fancy tomatoes that are shipped from greenhouses for more or less local consumption are packed in a small fancy crate like that shown in Fig. 18, which contains four small cartons, each of which holds about twelve good-sized tomatoes. The climax grape basket, shown in Fig. 19, is also coming into use to some extent for a small package for fancy and greenhouse tomatoes.

If a wholesale trade is being supplied, if the quality of the tomatoes is inferior, or if prices are low, it is usually most profitable to pack tomatoes for market in the field, as it saves at least the labor of an extra handling. Careful packing may be done in the field, but the best packing is done under a shelter of some sort. In the field, a tent, or awning will be of assistance, but a shed or special packing house is always to be preferred. A packing

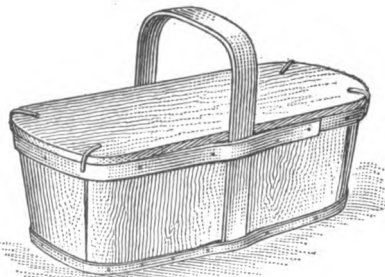


FIG. 19

house is especially valuable in bad weather. Many of the packing houses previously described for other vegetables will also answer for tomatoes.

In packing high-class tomatoes, only those all of one grade should be placed in a package. If this is not done, the off-grade tomatoes will greatly reduce the price of the entire package or perhaps of the entire shipment.

**120.** When tomatoes are to be shipped long distances, the less ripe ones should be placed in the bottom of the packages so that the extra pressure at the bottom will not be so injurious. Fully ripened fruits at the bottom of a package may be totally spoiled. Even when a local trade is supplied, it is often important to place the less ripe tomatoes on the bottom, because the marketman, and particularly the small grocer, will begin to sell from the top of the package in his store. Frequently, it will take him from 2 to 3 days to dispose of a bushel, and during that time the fruits at the bottom will have ripened and will be in good condition to sell.

All stems should be removed from fancy tomatoes, and the fruits should be placed blossom end up in the packages so that they will present the best appearance when inspected.

Many tomato growers face only the top layer of a package; that is, the fruits are arranged evenly so that they will show off to best advantage. This practice is perfectly allowable if all tomatoes under the top layer are of the same quality as those on the surface; but if the package is faced with much better tomatoes than those underneath, it will always react to the disadvantage of the packer. It is much cheaper to face only the top layer than to pack each layer carefully. The top layer of tomatoes should be level with the top of the package and the tomatoes should be of uniform size and color. After a grower who supplies a local trade has once gained a good reputation for honest packing, his tomatoes will rarely be inspected below the top layer by an old customer.

**121.** When tomatoes are to be packed in small fancy packages, such as the small boxes, etc., the packing table illustrated in Fig. 20 will be found to make the work easier and more

satisfactory than to use the common table or bench or to pack them direct from the baskets in which they are brought from the field. This table is 3 feet high, 3 feet wide, and 4 feet long. The top is made of canvas stretched loosely from the sides so that the fruit will rest on a yielding surface. Small rests *a* for

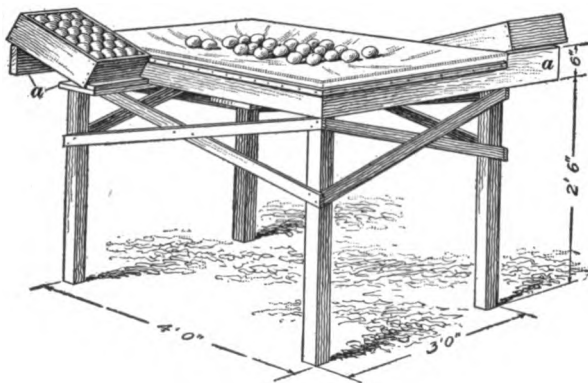


FIG. 20

the packages are made at opposite corners of the table so that two packers can work at once. The tomatoes are emptied on the canvas from either end. The upper edges of the frame should be padded and the canvas should run over these edges and be tacked to the sides.

### STORAGE

**122.** As tomatoes will ripen after they are picked from the vine, the tomato season can be somewhat prolonged beyond the time of frost by picking the tomatoes while they are still green and storing them until they ripen. Such storage is naturally much different from the storage of such vegetables as cabbage, celery, and the root crops, and lasts only for a short time.

Decay is the only thing that will prevent the proper ripening of tomatoes after they have reached nearly normal size. And, as the tomato is subject to rapid decay when the skin has been broken or the flesh bruised, the first essential to successful storage is careful handling to prevent all injuries. The lack of

careful workmen usually makes tomato storage unprofitable. Success in keeping tomatoes also depends to a certain extent on the variety. The fruit of such a variety as the Stone will keep exceptionally well. Usually as much as 75 per cent. of the green tomatoes picked can be ripened and sold later on, and such tomatoes often bring a price three times as high as that received for the ripe tomatoes at the time the crop was picked.

The best practice is to leave the tomatoes on the vines as long as possible, and to market the greater bulk of them direct from the vines. When, however, there is danger of injury from frost, all tomatoes that are large enough to pay for handling should be picked, the ripe ones sold immediately, and the green ones stored. In normal seasons in the northern sections of the United States, the first frost in the fall is usually a light one, and the fruit on tomato vines that have been grown on properly enriched land and that are quite luxuriant are practically uninjured by such a frost, even though the vines may be badly damaged. Tomatoes that are to be stored, however, should never be subjected to a severe frost.

**123.** Tomatoes may be stored in a variety of ways, provided they are picked and handled carefully and are kept in a dry place where the temperature does not go much below 40° F. Some of the more common ways are:

1. The fruit may be placed in crates or boxes and kept in a room or building where the temperature and moisture conditions can be controlled. Under such conditions a good percentage of the fruit will ripen, but frequent sorting is necessary to pick out the ripe fruits and those that begin to show signs of decay. This frequent sorting is expensive and causes more or less serious bruising of the tomatoes.

2. A better plan is to place the fruits, not over two or three deep, on a board floor where the sun and air can reach them and where the ripe fruit can be readily picked out without much handling of the unripe fruit. If a large space is so covered with fruits, paths should be left for the workmen every few feet. A cold frame, in which the ground has been covered with a floor of boards, makes a splendid place for the ripening of green.

tomatoes. The glass sash will admit plenty of light to the fruit, and ventilation can be provided during the day by raising the sash; on cold nights the sash can be closed. Tomatoes can be safely kept in cold frames until very cold weather sets in.

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### MARKETING

**124.** The market for tomatoes is active throughout the year, and a continuous supply is kept up from market gardens, truck farms, and greenhouses in many different parts of the country. In local markets, when the near-by crop is being sent in, many of the smaller markets will take thousands of bushels of this vegetable daily.

**125.** The prices received for tomatoes vary widely, because the fruit is perishable and because large quantities are frequently dumped on the market within a short space of time. Quality also has a big influence on the price received. Tomatoes of high quality well packed will always bring fair prices, even when the prices for the average product are very low.

Tomatoes are found in all the larger markets and in many of the smaller ones every day in the year. In the New York wholesale markets, tomatoes are largely sold by the six-basket carrier, shown in Fig. 17. From January to June, inclusive, practically all tomatoes are sold in this package. During July, August, September, October, and November the sales are both by the carrier and by the box, usually considered as a bushel box. In December, the carrier trade begins again, and most of the sales are by that package.

The highest extreme and average prices for tomatoes are received during the colder months of the year. The top-notch prices are received in January, after which the prices decline until September, when the low point is reached; good prices, however, are received as late as June and July. During September and October the prices are very low, but with the coming of cold weather in November and December they show a marked improvement. The most profit can be secured only by selling at the best prices and the tomato grower should aim to get his product on the market at the most advantageous time.

126. In Table II are shown for each month the extreme and average low and high prices per carrier and per box for tomatoes in New York wholesale markets for the 10 years from 1903 to 1912, inclusive. These prices are figured from the average low and high prices on the first and fifteenth of each month for the decade in question. The prices in the New York markets are considered particularly, because these markets are

**TABLE II**  
**PRICES OF TOMATOES IN THE NEW YORK MARKETS**

Month	Per Carrier				Per Box			
	Extreme Prices		Average Prices		Extreme Prices		Average Prices	
	Low	High	Low	High	Low	High	Low	High
January .....	\$0.75	\$5.00	\$1.23	\$3.63				
February .....	.75	6.00	.93	3.58				
March .....	.35	6.00	.81	3.53				
April .....	.35	5.00	.82	3.18				
May .....	.75	3.50	.90	2.98				
June .....	.50	4.50	.75	2.78				
July .....	.25	3.25	.45	2.13	\$0.50	\$2.75	\$0.81	\$2.50
August .....	.25	1.75	.30	1.11	.10	2.00	.27	1.58
September .....	.25	1.00	.36	.71	.10	1.00	.17	.91
October .....	*.20	.60			.15	1.50	.24	1.04
November .....	1.00	3.00	1.63	2.64	.10	2.00	.37	1.26
December .....	.25	4.00	1.14	3.08	*.75	1.25		

\*Quotations in this month only once in the 10-year period.

the largest in the country, and the prices there may be considered to be fairly representative. In many local markets, however, higher prices are often secured at corresponding seasons, because the tomatoes are first sent to the New York markets and then reshipped to the smaller markets.

127. In many local markets, the earliest tomatoes will sell for \$5 to \$6 a bushel, but the quantity sold at this price is

usually small. The best growers consider themselves fortunate if they can get \$3 to \$4 a bushel for their first few lots of tomatoes; the rest of the crop is sold for from 50 cents to \$1 a bushel. They expect to make the greater part of their profit on the early sales and to get merely enough out of the later part of the crop to pay expenses and perhaps a small profit.

In most local markets there is usually a demand for second-grade tomatoes, and considerable revenue can often be secured. The proportion of firsts to seconds will depend largely on the vigor of the plants; usually not more than 10 per cent. of a well-grown crop should be seconds. The best markets for seconds are those which cater to hotel and boarding-house trade; seconds can also often be disposed of to a canning or catsup factory. The sale of seconds as such should not injure the reputation of any grower. It is only the representation of seconds as firsts that reacts on a grower.

During the pickling season in the latter part of September and in October, there is a brisk demand in many local markets for green tomatoes. These commonly sell for 30 to 75 cents a bushel.



# EGGPLANTS AND PEPPERS

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## EGGPLANTS

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### GENERAL REMARKS

1. The **eggplant**, or *Guinea squash*, or as it is called by the French, the *aubergine*, belongs to the nightshade family and is a close relative of the potato, tomato, and pepper. It is a native of the tropics, and, although its home is not definitely known, was probably first grown in the East Indies. This vegetable is extensively cultivated in the tropics, and in the United States is most widely grown in the Southern States, where truck farmers grow it in large quantities. It is, however, successfully grown as far north as New York and Boston, although above the latitude of New York, the area on which it is grown is not extensive. The 43d degree of latitude seems to be the northern limit of commercial eggplant production; north of this the vegetable is produced commercially only in market gardens where the soil and climatic conditions have been found to be particularly suitable, and where the market demand has been found to be sufficient to warrant the expenditure necessary to the production of such an exacting crop. Eggplant is also grown to a limited extent under glass.

2. The eggplant crop is one that should not be attempted on a large scale without previous practical experience. The details of culture and watering must be carefully attended to, and the inexperienced grower may unintentionally slight some of these to the sudden ruin of a crop. As previously mentioned,

an average of about 2 acres of eggplant are grown per farm. Some experienced growers successfully plant a much larger acreage than this, but from  $\frac{1}{4}$  to  $\frac{1}{2}$  acre is usually sufficient for the beginner to start with. The marketing facilities have an important influence on the quantity of eggplant that can be profitably produced on a farm. In sections where there are few foreign-born persons caution should be exercised not to plant extensively until the demand is assured. As previously indicated, the vegetable can probably be safely cultivated more extensively on the truck farms of the South Atlantic States, notably in Florida and Virginia, from which sections the crop is mostly shipped to the larger centers, than in many of the market garden regions.

3. Eggplant is most commonly prepared for eating by cutting it crosswise in slices from  $\frac{1}{4}$  to  $\frac{1}{2}$  inch thick and frying the slices in a batter. Many cooks, before frying the slices, salt them thoroughly, pile them on a plate, and allow them to stand for a time to remove the somewhat acrid taste common to the vegetable. In France, the eggplant is used to some extent in soups and stews.

The eggplant has a flavor peculiar to itself, and this is not at first liked by many persons. A taste for the vegetable is easily acquired, and the vegetable is then usually highly esteemed. Eggplants are wholesome but not very nourishing, as they contain a large percentage of water.

4. **Commercial Importance.**—The total value of the eggplant crop in the United States is small as compared with the immense crops of some of the staple vegetables. In 1909, it was only \$154,643, grown on 894 acres, distributed among 459 farms; this is an average of nearly 2 acres per farm; these figures include only patches of 1 acre and over; a large part of the crop of the United States is grown in less than 1-acre lots.

Eggplant is extensively cultivated commercially in twenty-five states. The ten principal states, ranking in order, are: Florida, New Jersey, Virginia, Massachusetts, Maryland, Louisiana, New York, Texas, Colorado, and Rhode Island. These ten states produced more than 92 per cent. of the total

crop, the first three produced more than 75 per cent., and Florida alone produced more than 42 per cent. This shows that the bulk of the crop is produced along the Atlantic seaboard and that most of it is grown in the southern part of this section. The states where it is most extensively cultivated are those in which there is a large foreign-born population, or where the truckers raise it to ship.

5. The average income per acre from eggplant in the United States is about \$172; in Massachusetts, \$567; in Colorado, \$440; in Rhode Island, \$333; in New York, \$287; in Virginia, \$268; in Florida, \$192; in Maryland, \$170; in Texas, \$130; in New Jersey, \$108; and in Louisiana, \$95. In the more northern states the market gardeners secure a high income per acre, but their expenses are correspondingly higher.

6. **Cost of Production and Income.**—The cost of production per acre for eggplants will vary with the management, the climatic and soil conditions, etc. The following estimate made by a prominent New England market gardener will serve as a guide in estimating the probable cost of a crop:

	MODERATE ESTIMATE	LIBERAL ESTIMATE
Use of the land.....	\$5.00	\$10.00
Preparation of land (plowing and harrowing) .	5.00	10.00
Fertilization.....	25.00	40.00
About 3,220 plants at \$25 per 1,000.....	80.00	80.00
Setting.....	5.00	8.00
Cultivation and hand hoeing.....	12.00	16.00
Harvesting and preparation for market.....	25.00	50.00
Total.....	\$157.00	\$214.00

To these figures must be added the cost of getting the product to market and the commissions or other charges for selling. Such items will, of course, vary with the distance from market, transportation rates, and the arrangements made for selling.

The net returns per acre will vary with the cost of production, the yield, and the prices received. Under the best methods of culture, the large varieties of eggplants, like the Black Beauty

and the New York Improved, should yield from three to six fruits; four fruits to the plant would be a high average. If the plants are set 3 feet by 4 feet, about 3,796 per acre, an average yield of four fruits per plant would give about 1,265 dozen fruits per acre; extensive growers consider 1,000 dozen a very high yield. From 35 cents to \$1 a dozen is received for the fruits; a gross income of about \$400 an acre is considered good.

**7. Climatic Requirements.**—Because of the tropical, or, rather, subtropical character of the eggplant, it thrives best only in warm climates, where there is a long growing season and the nights are warm. Low temperatures at night, even where the temperature is high during the day, will seriously check the growth of the plants, and unless the growing season is fairly long the fruit will not have time to develop. When planted in sections of the country where the nights are likely to be cold, eggplants should always be set on a warm, southern exposure. The extensive culture of eggplants in the South is due to the favorable growing season there.

**8. Soils.**—Eggplants probably thrive best on a well-drained medium loam, but will also do well on sandy soils. On account of the heat-loving nature of the plant, soils that warm up quickly are preferable, and hence eggplant can seldom be produced to advantage on clay soils, unless these soils are exceptionally well supplied with organic matter and the climatic conditions are particularly favorable. For the best results the soil should be deep, well supplied with plant-food, retentive of moisture, and well drained. A large percentage of humus is desirable, and on almost all soils irrigation will be beneficial, because at certain times during the growing season the need of water is keenly felt.

## VARIETIES, SEED, AND PLANT PRODUCTION

### VARIETIES

9. Eggplants are of three different colors, namely, black, purple, and white. The so-called black varieties, which are really a dark purple, are the most important commercially, because they meet with the greatest demand. The lighter-colored purple varieties are less important commercially, because



FIG. 1

the fruit is smaller than the black; they are, however, of an attractive appearance. There is little demand for the white varieties and they are seldom found in American markets.

10. The two principal market varieties of eggplant are the *Black Beauty* and *New York Improved*. The *Early Long Purple* is also found in the markets in smaller quantities.

11. The **Black Beauty** eggplant, shown in Fig. 1, is in reality an improved strain of the New York Improved. It is about 10 days earlier than the New York Improved and is a very popular variety. The plant grows to a height of about 2 feet, has a spread of about 2 feet, and bears a dark-purple, well-rounded fruit, which, when of a good marketable size, measures about 6 inches both in length and breadth at the extreme points. The fruit of this variety tapers slightly from the blossom to the stem end and reaches its greatest circumference at a point about one-third the way from the blossom end. This plant, like all its near relatives, blossoms and develops

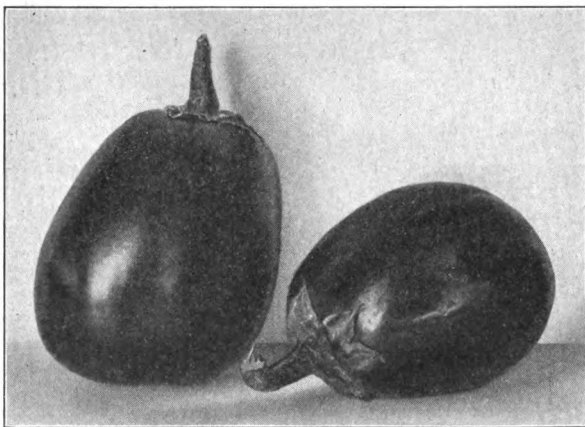


FIG. 2

fruit throughout the growing season, and, provided the plant can be kept healthy, the longer the growing period the larger the yield will be. The yield from well-tended plants will vary from five to fifteen marketable fruits per plant.

12. The **New York Improved** eggplant, shown in Fig. 2, is one of the most popular of the purple varieties. Both the plants and the fruits grow larger than those of the Black Beauty. The color of the fruit is a trifle lighter than that of the Black Beauty and the shape is less round; the length of the fruit from the stem to the blossom end is about one-third greater than the opposite greatest diameter.

**13.** The **Early Long Purple** eggplant is earlier and hardier than either of the foregoing, and is particularly well adapted to culture in the northern parts of the United States, where the larger varieties do not succeed well. As the name indicates, the fruits are purple, and they are from 9 to 10 inches long. This is a good variety for the home garden but is not much in demand in the wholesale markets.

**14.** The **Ivory** eggplant is one of the white varieties occasionally grown in the United States. A number of white varieties are accepted in European markets, but are not popular in America. The white varieties are generally considered to be of better quality than the purple varieties.

**15.** In addition to the **Early Long Purple**, there are a number of other long-fruited varieties which are abundant yielders and are suitable for the home garden; however, because of their shape, they are not so popular in the markets as the round-fruited varieties.

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#### SEED AND SEED PRODUCTION

**16.** The production of eggplant seed is not a difficult task, and may be profitably done in sections where the plant succeeds well, as in certain parts of the South, namely in Florida, Virginia, etc., although considerable seed is grown in the North and many Southern growers buy Northern-grown seed; much eggplant seed is grown in Southern New Jersey.

The first step in seed production is the selection of the plants from which the seed is to be saved. All imperfect or dwarfish plants in the seed plat, or patch, should be cut out as soon as they reach a fair size, and only the more perfect and symmetrical plants should be left. The important points to consider in selecting seed plants are: (1) the qualities of the parent plant, which includes the thriftiness of growth and productivity; (2) the suitability of the type of plant to the kind of soil available and the climatic conditions; and (3) the conformity of the fruit to market requirements.

**17.** The details of the work of selecting eggplant seed plants and the fruits on them are the same as recommended

in the case of cucumbers. The plants selected should be staked and a piece of cloth should be tied about the stem above the fruits that are to be saved. After the seed plants are selected all of the less desirable fruit should be cut off of the plants. Usually the first fruits of the desired type that set are allowed to remain so that they will have as long a growing season as possible.

18. The time for picking fruit that is to be saved for seed can be determined most satisfactorily after a little experience. The fruit should be allowed to mature thoroughly on the plant but should not be allowed to remain long enough for decay to set in. When the seeds mature the skin of the fruit usually turns a lighter color and sometimes even becomes somewhat yellow. The fruit should be allowed to remain on the plant until it becomes fairly soft. At this stage the fruit should be cut and taken to a shed, commonly the packing shed, where it is piled up until sufficient has been collected to furnish enough work to keep the cutters busy for a considerable time without delays. The fruits may be allowed to remain in a pile as long as 2 or 3 days without danger of rotting.

The flesh of the fruit is pared off until only the part containing the seed is left. This core should be cut lengthwise into quarters or eighths with a knife that is much duller than that used for paring off the flesh, in order to prevent injury to the seed. These sections should then be packed in barrels and covered with water; the pieces of eggplant should fill only about two-thirds of the barrel in order to allow for expansion. Fermentation will set in very shortly, and the pulp should be allowed to remain in the water for 3 or 4 days. This fermentation causes the flesh about the seed to become a soft, pulpy mass, and facilitates the separation of the seed from it later. This process is sometimes called maceration. The active fermentation should not be allowed to continue more than 2 or 3 days, because the heat produced by this process combined with the heat of the summer weather is likely to cause the seed to germinate and thus render it valueless. When the fermentation process has continued long enough, the pulp is lifted out of the barrels

and the softened flesh is separated from the seeds. A thorough washing in running water will take away a large part of the flesh. If this is done over a fairly coarse screen, the seed may be washed through on to a finer screen that will hold them, and the bulk of the pulp will remain on the first screen. After this the seed should be dried, and then the small particles of pulp can be separated from the seed by rubbing between the hands.

The drying of the seed should be done in the shade, in order to prevent any tendency toward heating and germination; the seed should be stored where it can be kept dry and free from mold. Dryness can be insured by wrapping the seeds in paraffin paper or tinfoil. Care should also be taken to store the seed where it will be protected from the attacks of rats and mice. A screen storage box such as recommended for sweet corn is suitable for this purpose. From 100 to 250 or 300 pounds of seed can be secured per acre.

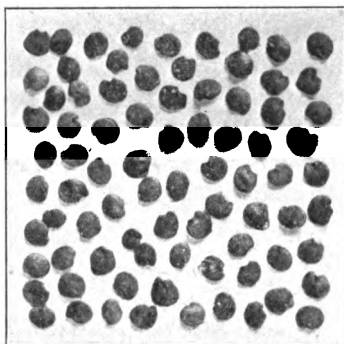


FIG. 3

19. If properly separated from the pulp and well stored, eggplant seed will retain its power of germination for about 6 years, and in extreme cases as long as 10 years. Unless, however, all the conditions surrounding the production of the seed are known, the use of seed more than 2 years old is not advisable. To be considered high grade, eggplant seed should be 99 per cent. pure and about 90 per cent. of the seed should germinate. Eggplant seed should germinate in 8 to 15 days.

Eggplant seed are of medium size; about 5,000 to 7,000 will weigh 1 ounce; 1 quart will weigh nearly  $19\frac{1}{2}$  ounces. A sample of eggplant seed of the Burpee's Black Beauty variety is shown actual size in Fig. 3. About 1 ounce of seed is usually considered sufficient to produce 1,000 or more good plants for setting in the field. At this rate from 3 to 7 ounces will be required for

the production of enough plants to set 1 acre, according to the distances the plants are set. Eggplant seed retails at \$2.50 to \$5 a pound, according to the quality and strain.

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#### PLANT PRODUCTION

**20.** The production of eggplant plants for setting in the field is an exacting task and should be attempted on a large scale only by persons having considerable experience. The best results can be secured only when no serious check is given to the plants from the time of the sowing of the seed until the fruit is ready for harvest. Every check, no matter how slight, will produce some undesirable effect, the degree of injury depending on the severity of the check and the length of time the plants are subject to unfavorable conditions. Plants that are severely checked will sometimes struggle along to a fair size and mature one or two fruits, but they can never be expected to make a maximum production. Particular care should be taken to avoid checking the plants during the time when they are being hardened off prior to being set in the field. Mistakes are often made at this time. The hardening off should be done gradually.

**21.** The time necessary to produce eggplant fruit from seed depends on the soils, on the climatic conditions, and on the management. During cool weather or when the plants are not supplied with enough heat in the hotbed or greenhouse, the plants will grow slowly. During hot weather, when enough moisture is present, the plants will develop rapidly and will mature their fruit much earlier than in cold weather. On an average, from 120 to 150 days will be required to secure fruit from seed, and when an earlier crop is desired, the seed should be sown under glass about that long before the fruit is wanted. In the latitude of New York and in the West, eggplant seed is commonly sown in the hotbed from February 20 to March 10; in the South, the seed is sown under glass from December 20 to January 10. Ordinarily, the seed should be planted about 3 months before climatic conditions will warrant field setting.

**22.** The production of plants in the hotbed is similar to the production of other vegetable seedlings, except that the eggplant seedlings require considerable heat. During the night the temperature should not fall below 60° F. and during the day in the bright sunshine it may be allowed to go as high as 90° F. The eggplant seedlings should be kept in a slightly dry rather than in a wet environment, because dampness favors the development of the damping-off fungus, and if allowed to start this is likely to do serious damage.

The seed is most commonly sown in the hotbed or greenhouse in drills about 2 inches apart, and the seedlings are transplanted several times. The first transplanting is made when the leaves begin to appear or when the plants begin to look spindly. At this time they are usually set in another bed in the center of a 2-inch square. A second transplanting is usually made when the seedlings begin to crowd, at which time they are sometimes set in the center of a 4-inch or a somewhat larger square. The third transplanting, which is the setting in the field, is made when the plants are about 6 inches high; the transplanting should be done only when the weather conditions are favorable.



FIG. 4

**23.** A practice that is increasing in favor is to grow eggplant seedlings in pots. Common clay flower pots may be used, but the home-made paper pot or one of the many kinds of paper pots on the market is usually more economical and much easier to handle. The seeds are planted first in 2-inch pots, three or four seeds in a pot, and the seedlings thinned to the best one of the lot after they have grown to a height of 1 inch or so. Sometimes the seed is planted directly in the bed of the hotbed and set in pots shortly after the seedlings come up. As soon

as the roots fill the pot, or the plants become pot bound, the seedling should be transplanted to a 4-inch pot and then to a 6-inch pot. A seedling should never be allowed to remain in a pot for any length of time after the roots have filled the available space, or the growth may be undesirably checked. By transferring the seedlings from one pot to another, eggplant seedlings can be grown under glass until the flowers appear, and sometimes even until the fruit has set, and then transplanted to the field without checking the growth of the plant or injuring its productivity. When being set in the field, the plants should be taken out in the pots and not taken from the pots until just as they are to be placed in the ground.

An eggplant seedling in a pot ready for transplanting is shown in Fig. 4.

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#### PLANTING AND GENERAL OPERATIONS

**24. Planting.**—The soil should be thoroughly prepared for eggplants, so that the moisture will be well conserved. In many cases an early crop such as lettuce, radishes, or spinach is produced on the land before the eggplant plants are set. In such a case, well-rotted manure is applied to the ground early in the spring and plowed under, and after the early crop is removed the ground is either replowed or thoroughly disked and harrowed two or three times, so that a good dust mulch is provided. This mulch should be maintained until the plants have been set.

**25.** Because of the susceptibility of eggplants to cold, they should never be set in the field until after danger of injury from this cause is past. In the latitude of New York City, particular care should be taken not to plant this vegetable too early, because in this latitude the weather during the latter part of May is frequently so cool, or even cold, that eggplants exposed to it may be seriously checked. Hence, the best time for setting in localities in this latitude is between June 1 and 10, and under most circumstances the latter date will be preferable. In the latitude of Norfolk, Virginia, the plants are set in the open in April and May, and in the latitude of the southern part of

Georgia from January 15 to February 1. In the West, eggplants are set in the field from May 25 to June 15.

**26.** The distances of planting will depend on the varieties, the size to which the plants may be expected to grow on the soil in question, and the ability of the soil to support heavy cropping. In many of the trucking sections the plants are set in rows of 4 or 5 feet apart and the plants are spaced 3 feet apart in the row. In some of the market-gardening sections, the rows are spaced 3 to 4 feet apart and the plants are spaced as close as 2 feet apart in the row and from that up to 4 feet apart. These distances will naturally require widely varying numbers of plants per acre and thus greatly influence the possibilities of securing a large crop. When planted 3 feet by 3 feet, about 4,840 plants will be set per acre; at 3 feet by 4 feet, about 3,630 plants; and at 3 feet by 5 feet, about 2,900 plants; at the closer spacing of 2 feet by 3 feet, about 7,260 plants; and at 2 feet by 4 feet, about 5,445 plants.

**27.** When of a good size for transplanting, the plants will be from 6 to 10 inches tall, branched and budded, and care must be exercised in transplanting them in the field so as not to injure them in any way and thus check their growth. They should be protected from the wind and sun and should not be removed from the pot in which they were grown, or from the basket in which they were carried to the field until just as they are to be set in the ground. When removing a plant from a pot the sides and the bottom of the pot should be tapped gently to loosen the earth, and the entire ball of earth is removed and set in the ground. Where paper pots or strawberry baskets are used for plant containers, these are set in the ground after the bottoms have been removed and the plants are not disturbed. If the plants are set carefully in this way, watered as soon as set, and cultivated carefully an almost perfect stand should be secured. Hand transplanting is usually preferred to machine setting, provided careful setters can be secured, because the plants are rather delicate and of such a size that they are likely to be injured by machine setting.

**28. Cultivation.**—The cultivation of an eggplant patch should be thoroughly and frequently done, but should be

governed somewhat by the weather conditions. The cultivation should be so managed that there will always be plenty of moisture and air in the soil. During a wet season, the soil should be cultivated as deeply as possible without damaging the root systems of the plants, in order to prevent the accumulation of too much moisture in the soil and to permit the entrance of sufficient air; if deep cultivation was started early in the season, it may be continued throughout the growth of the plants, but caution should be used in starting it late in the season after shallow preliminary cultivation. During a dry season, the cultivation should be shallow but frequent; in a dry season, it is essential to maintain a dust mulch and to prevent the growth of weeds, in order to conserve moisture; there is little danger of the soil not being well aerated.

**29. Pruning Out the Buds.**—When eggplants are grown in localities where the season is short or when it is desired to hasten the maturity for any other purpose, it is a common practice to pinch off the later blossoms. Whether or not this will be profitable will depend to a great extent on local conditions. The labor expense of pinching off the buds is considerable and should be done only in exceptional cases. By reducing the number of buds on a plant, the entire energies of the plant are thrown into a smaller number of fruits and naturally these are hastened to maturity and developed to a larger size. Sometimes when the plants have not made a good growth during the early part of the season and there is danger of all of the crop being lost by frost, pinching off a large part of the buds will often pay well. This pruning should be done about 3 weeks before frost is usually expected. At other times, a shortage in the market may offer an opportunity for a profitable sale of eggplant fruits that can be secured rather quickly, and pinching off all of the smaller buds and even some of the smaller fruits may be advisable to hasten the maturity of those remaining.

**30. Fertilization.**—Because the first eggplants in the market bring much higher prices than later ones, the plants should be fertilized so that they will make the quickest growth

possible. This necessitates the production of strong foliage, but too much foliage growth should not be stimulated or the fruit yield will be diminished.

Fresh stable manure should not be applied in large quantities immediately preceding the setting of eggplants, because this will tend to stimulate the leaf and stem growth at the expense of the fruit; a small quantity of fresh stable manure may sometimes be applied to advantage at this time; fresh stable manure should ordinarily be applied to the preceding crop. Well-rotted stable manure at the rate of 15 to 20 tons to the acre is most suitable to apply immediately before a crop. Following its application, a rather deep plowing and harrowing should bring a soil into good condition for eggplants.

Eggplants respond to commercial fertilizers more than many other crops. Before the plants are set in the field, from 800 to 1,000 pounds of a fertilizer analyzing 3 per cent. nitrogen, 8 per cent. phosphoric acid, and 8 per cent. potash should be applied broadcast and be well harrowed into the upper 4 inches of soil; some growers find that they can profitably apply as much as 1,500 pounds of such a fertilizer. This fertilizer is applied in addition to the manure.

After the plants are set, top dressings of from 150 to 200 pounds of nitrate of soda per acre should be made. The first of these should be applied a few days after the plants are set, and about two more made at intervals of 2 weeks. The quickly available nitrogen in this material will stimulate a quick and vigorous leaf growth early in the season, but the stimulation in this direction will cease shortly after the last application is made and the energies of the plant can then be devoted to maturing the fruit. The nitrogen in fresh stable manure, on the other hand, is less slowly available and sustains leaf growth beyond the desired stage.

When fertilized in this way, and otherwise well taken care of, eggplants should bear marketable fruits in from 1 week to 10 days earlier than when the top dressings of nitrate of soda are not given.

### INSECT PESTS AND INJURIES

**31. Insect Pests.**—Few insect pests attack eggplants. The **Colorado potato beetle** is fond of this plant and at times will inflict much injury on it. A discussion of this insect is given in a previous Section. The only known method of control is by means of a stomach poison, such as arsenate of lead, etc.

**32.** The **flea beetle** is a persistent enemy of all plants of the family to which the eggplant belongs. This insect has also been previously discussed.

**33.** The **cutworms** and some **aphids** will also attack eggplants but are seldom troublesome; at times cutworms will do severe damage on young plants. Eggplants should not be set in fields that are known to be badly infested with cutworms.

**34.** The **cotton boll worm**, in the South, attacks the eggplant and bores holes in the stems and fruit. This insect does the most damage on the young fruit.

**35. Fungous Diseases.**—There are two common fungous diseases of eggplant, namely, anthracnose and leaf spot.

**36. Anthracnose** attacks the fruit of the plant and causes the formation of shallow pits, in which the fungus can be seen in the form of pink blotches. Serious damage may be prevented by spraying with a good fungicide, such as 4-5-50 Bordeaux mixture (4 pounds of copper sulphate, 5 pounds of stone lime, water slaked, and 50 gallons of water).

**37. Leaf spot** is a more serious disease of eggplants than anthracnose. As its name indicates, it attacks the leaf tissue and causes the affected parts to turn brown and later to become dry and brittle. As in the case of other fungous diseases of similar character, these spots spread until large sections of the leaf and sometimes the entire leaf is destroyed. The fruit is also affected, the result on this being a brown rot.

The same Bordeaux mixture recommended for anthracnose will prevent damage from leaf spot, provided it is applied early

enough in the season. In sections where there is particular danger of infection, spraying should be commenced in the seed-bed and be continued at intervals of 2 or 3 weeks until the fruits are so near marketable size that further sprayings might injure their appearance.

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## HARVESTING AND MARKETING

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### HARVESTING

38. In the latitude of New York, the first eggplants attain marketable size during the latter part of July. The eggplant is peculiar in that no distinct ripening of the fruit takes place. The fruit is of the same edible quality at all stages of its growth from the time it is about one-third grown until it begins to soften with age and the seeds turn color. Hence, harvesting is started as soon as the fruits are large enough to bring a good price, and is continued as long as the plant will bear marketable fruit, which will sometimes be until frost kills the plant.

Eggplants of different varieties are of different sizes when they are harvested for market, but on an average a fancy fruit should be about 8 inches long and 5 inches in diameter at the thickest point. The fruit should be somewhat egg-shaped, rounded at the blossom end, and tapering somewhat toward the stem end. In American markets, fruit colored a dark purple is the most popular.

39. If the fruit is regularly harvested before it reaches too large a size—that is, before the seeds begin to mature—the life of the plant will be considerably prolonged, and under such conditions a single plant may be made to yield from five to fifteen marketable fruits. The fruit should be cut from the plant with a sharp knife or with nippers, instead of being broken off; a 2-inch stem should be left. When cut in this way, eggplants will stand up well for a number of days.

The fruits should be carefully handled after they are cut, for a bruise that may not be severe enough to be noticeable immediately, will cause decay and will usually deface the

surface of the fruit with a brown spot within 24 hours. A fruit marked in this way will never be accepted as first class.

40. As soon as the fruit is cut from the plant, it should be placed in baskets and taken to a packing shed, where it should be packed either in boxes or in barrel crates. Miscellaneous packages are used for a local market. When the fruit is to be shipped to distant markets it is often wrapped, sometimes in brown paper and sometimes in fancy paper; the fruit stands up much better in shipment when it is wrapped.

On account of the fact that eggplant is not especially perishable, like some crops, it may often be shipped by freight rather than by express and the difference in transportation charges saved by the grower. It will also carry well in a market wagon.

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#### MARKETING

41. The demand for eggplants is limited somewhat to the larger cities, and is most active in the foreign quarters of these centers of population. Many native-born Americans are not familiar with the eggplant and therefore are unable to appreciate it as a table delicacy. Foreign-born persons commonly buy eggplant only during the warm weather, when it is low in price. During the colder months it is rarely purchased by any but the better class of trade.

The demand for eggplants is most active during the early months of the year, and during this time the demand is seldom fully supplied. The limited number of people who are well acquainted with this vegetable, however, makes for it a somewhat limited market, and means that it cannot be profitably sent to market in large quantities at all times of the year.

42. The crops of the Southern and Northern growers now furnish eggplant for the market at all seasons of the year. During the summer months, when the crop from the North is in the market, the prices are naturally depressed, but the demand has been increasing, especially in late years, and, as a general rule, the market is seldom glutted; usually, all that are offered can be sold at some price. The eggplant is not so

perishable as many vegetables, and because of this fact an oversupply in the market does not always greatly reduce the price to the consumer, but rather causes an accumulation of

**TABLE I**  
**PRICES OF EGGPLANT IN THE NEW YORK MARKETS**

Month	Per Box				Per Barrel			
	Extreme Prices		Average Prices		Extreme Prices		Average Prices	
	Low	High	Low	High	Low	High	Low	High
January.....	\$1.00	\$12.00	\$1.50	\$5.72				
February.....	1.00	12.00	1.43	4.85				
March.....	1.00	7.00	1.53	4.00				
April.....	1.00	5.00	1.40	3.90				
May.....	.75	4.00	1.19	3.06	*\$2.00	\$3.25		
June.....	.75	3.50	1.11	2.66	* 1.00	3.00		
July.....	.50	4.00	.85	2.15				
August.....	.20	2.50	.41	.93				
September....	.25	.60	.28	.50	.50	1.75	\$0.66	\$1.30
October.....	.40	1.75	.97	1.17	.50	3.50	.91	1.87
November....	1.00	5.00	1.44	2.94				
December .....	1.00	4.00	1.38	3.25				

\*Quotations in the month only once during the 10-year period.

the product and a diminution in the quantity sent to market until the oversupply has been disposed of.

43. Like other vegetables, the prices paid for eggplant in any market will show wide variations. An examination of the prices in the New York wholesale markets for a decade shows that the prices vary several hundred per cent. in the same month. In these markets eggplants are most commonly sold by the box, which contains about 1 dozen large fruits. During some of the summer and the early fall months they are also sold by the barrel, which holds from 65 to about 110 or 120 eggplants. They are also sold by the crate and by the

half-barrel basket, or hamper. In the boxes, fancy eggplants are often wrapped in paper to prevent bruising and chilling.

Eggplants are found in the New York markets every month in the year. The highest extreme and highest average prices are secured in January. From this time the prices decline, although good prices are received for several months, until they reach their low point in September, at which time they sell from 25 to 60 cents a box and from 50 cents to \$1.75 a barrel. From then on the prices begin to pick up as the cold weather approaches, and reach their high point again in January.

44. In Table I is shown for each month the extreme low and high prices and the average low and high prices per box and per barrel of eggplants in the New York wholesale markets for the 10 years from 1903 to 1912, inclusive. These prices are figured from the average low and high prices on the first and fifteenth of each month for the 10 years. The prices in the New York markets are considered in detail, because immense quantities of eggplants are annually received in there and the prices are fairly representative. In many local markets eggplants are sold by the dozen and usually bring from 35 cents to \$1.

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## PEPPERS

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### GENERAL REMARKS

45. The **pepper** known to the American gardener is a relative of the eggplant, tomato, and potato, and is the source of the red pepper of commerce. The black and the white peppers of commerce come from a plant of an entirely different botanical family, which is grown in tropical Asia more than elsewhere. The pepper of American gardens is botanically known as *capsicum*. It is a native of the tropics of the western hemisphere, and is usually considered to have originated in Brazil. It was introduced into the eastern hemisphere by Columbus on his return from America. In America, the pepper is now widely grown as a truck-farm, a market-garden, and a home-garden crop.

46. The various kinds of peppers are extensively used in hot climates for seasoning a large variety of dishes. The daily consumption of this plant in hot climates tends to prevent the occurrence of bowel complaints, and this is probably the reason for its extensive cultivation in tropical countries.

The small, hot peppers are largely used for seasoning. The Cayenne and similar peppers are dried and ground and used as a condiment. Some of the small, hot peppers are ground and mixed with strong vinegar to make a pungent, biting sauce. The hot peppers are also rubbed on meats in hot countries to keep insects from infecting them.

The large, sweet peppers are used for pickling, alone and with other vegetables, are stuffed and cooked, and are used less commonly in salads. For pickling, the peppers are picked either in the green or in the red, or ripe, state. Mangoes are the large peppers that have been cut in two lengthwise, stuffed, tied together again, and then preserved in a pickling solution.

**47. Commercial Importance.**—The pepper crop in the United States compares favorably in total value with most of the less important vegetables. In 1909, the total value of the crop was about \$403,741, raised on 3,493 acres, distributed among 1,641 farms; this shows an average of 2.12 acres per farm, although in some sections the average is five or six times that large.

Peppers are cultivated commercially in about thirty-five states. The ten principal states producing the crop, ranking in order of the value of the crop produced, are: New Jersey, Florida, California, Texas, New Mexico, Illinois, Massachusetts, New York, Louisiana, and Connecticut. These ten states produced more than 93 per cent. of the total crop, New Jersey alone produced more than 36 per cent.; Florida, more than 23 per cent.; and California, more than 13 per cent.

48. The average income per acre from peppers for the United States is about \$117; in Florida it is \$318; in Massachusetts, \$268; in Texas, \$221; in Illinois, \$148; in Connecticut, \$133; in California, \$125; in New York, \$120; in Louisiana, \$110; in New Jersey, \$79; and in New Mexico, \$58. Skilful

growers in these states greatly exceed the average income per acre; in fact, in some cases, they find it profitable to spend more than the average income per acre for the state in producing the crop.

**49. Cost of Production and Income.**—As in the case of other vegetable crops, the cost of production of 1 acre of peppers will vary with the management and with the local climatic and soil conditions. The cost of production of a crop of sweet peppers, as estimated by a prominent market gardener, is as follows:

	MODERATE ESTIMATE	LIBERAL ESTIMATE
Use of the land.....	\$ 5.00	\$ 10.00
Preparation of land.....	5.00	10.00
Stable manure and commercial fertilizer..	20.00	50.00
About 7,260 pepper plants at \$5 to \$12 per 1,000.....	36.00	87.00
Setting.....	5.00	10.00
Cultivation and hoeing.....	7.00	14.00
Harvesting and preparation for market	25.00	40.00
Total.....	\$103.00	\$221.00

To these estimates must be added the cost of sending the product to market and the selling charges in the market. A grower near a good local market will often be able to sell to better advantage than one at a considerable distance. The moderate estimate would probably be a cost estimate of the cost of production for peppers raised on a truck farm; the liberal estimate would come nearer to the cost of production of the average market garden.

The gross returns per acre from peppers will vary with the yield and the prices received, and the net returns will depend on these factors and the cost of production and marketing. The yield per acre of peppers varies considerably with the variety and with the season. Plants set 2 feet by 3 feet, and yielding an average of seven marketable peppers each, will yield about 50,000 peppers per acre; the plants of some of the medium and small varieties will yield from fifteen to twenty

fruits, and some of the giant kinds not more than three to five fruits. A good yield of peppers is from 250 to 400 bushels to the acre, and 600 bushels have been secured. At prices of from 75 cents to \$1 a bushel, the gross income per acre would vary from about \$185 to \$400.

**50. Climatic Requirements.**—The pepper is tender to frost but less so than eggplants and tomatoes. The climatic conditions existing from the southern part of New Jersey south along the Atlantic ocean, particularly in Florida, and also in Texas and California are particularly well suited to the needs of this crop. Although the pepper is a native of the tropics, it is, as previously shown, cultivated over a wide range of territory in the United States.

**51. Soils.**—The pepper plant thrives best in a light, sandy loam soil that will warm up quickly and that is fertile and fairly retentive of moisture and well drained. The bulk of the commercial crop is produced on such soils, although the crop is also produced commercially on some of the heavier soils that are well supplied with humus.

Soils that have a southern exposure will produce earlier and usually larger crops than soils having other exposures. The plant is a great lover of heat, and an abundance of heat means a quick growth and an early, abundant yield.

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## VARIETIES, SEED, AND PLANT PRODUCTION

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### VARIETIES

**52.** The many varieties of peppers on the market may be classed in two groups: (1) The *hot*, or *pungent*, peppers, and (2) the *sweet*, or *mild*, peppers, or *mangoes*.

The hot peppers are used largely as a condiment for flavoring soups, stews, and similar foods, and in hot pickles; they are most popular in warm climates. The sweet peppers are eaten stuffed and cooked, or cooked in other ways, and are used in some of the milder pickles. They are not extensively used as

a vegetable, but there is a more or less brisk demand for them from August 1 to October 1. In Northern markets, Southern growers extend this season somewhat.

The pepper plant of average size grows to a height of about 18 inches, and has a spread of about 15 inches. It grows in the form of a vase from one stout, woody stem at the surface of the ground.

**53. Hot Peppers.**—The leading varieties of the hot peppers are the *Long Red Cayenne*, *Tabasco*, and *True Red Chili*.

**54.** The **Long Red Cayenne** pepper, shown in Fig. 5, is the leading variety of the hot, or very pungent, varieties; there



FIG. 5

are many strains of this variety. The fruits of this variety grow about 3 to 5 inches long, are about  $\frac{1}{2}$  inch thick at the stem end, and taper to a point at the tip; when ripe, they are a bright scarlet and are very pungent. The plants bear early and are very productive. The powdered Cayenne pepper of commerce is made from the dried, ripe fruits of this variety.

**55.** The **Tabasco** pepper, shown in Fig. 6, is the hottest of the small, bright-red peppers. The vines are tall and bush-like, growing from 3 to 4 feet in height, and are productive of a large number of fruits. The peppers are small, about 1 inch in length, and slender; when ripe, they are a bright scarlet, and extremely hot; tabasco sauce is made from this pepper. This

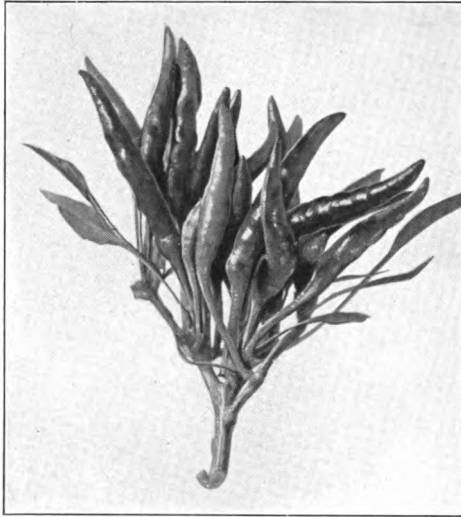


FIG. 6

variety succeeds best in the South; as far north as the latitude of Pennsylvania it will not usually ripen its fruit.

**56.** The **Chili**, or *True Red Chili*, pepper is somewhat similar to the Tabasco pepper. The fruits are small, bright red, and very hot, although not as hot as those of the Tabasco.

**57. Sweet Peppers.**—Among market growers, the most popular varieties of sweet peppers are the Ruby King, the Bull Nose, or Large Bell, the Chinese Giant, and the Squash. All these peppers are a bright red when ripe, but are commonly marketed green.

**58.** The **Ruby King** pepper, shown in Fig. 7, is valuable because the fruit is of a size, shape, and quality that is hard to

surpass, and still the plants yield well. The plant is a strong grower and develops to a height of about 2 feet. The fruit is symmetrical in shape, and a good average specimen will measure from 3 to 4 inches long and 2 inches in diameter at the top; the fruit is four-lobed and when ripe is red; the flesh is thick, sweet, and of a mild flavor. The fruits of this variety find a ready sale where sweet peppers are in demand; they are excellent for the making of mangoes, or stuffed pickled peppers.

**59.** The **Bull Nose**, or *Large Bell*, pepper, shown in Fig. 8, the plants of which grow about 2 feet high, are prolific,

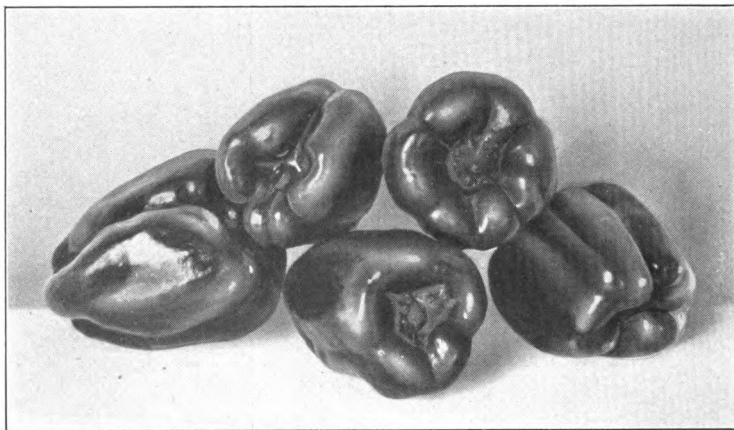


FIG. 7

and bear fruit early. The fruit is similar to that of the Ruby King, but is usually somewhat more blocky and a trifle smaller; an average fruit is about 3 inches long and 2 inches in diameter. When ripe, the fruit is scarlet, and in different strains the flavor varies from mild to very pungent; occasional plants in a mild strain will also bear pungent fruits. The fruits reach a marketable stage sooner than those of the Ruby King.

**60.** The **Chinese Giant** pepper is shown in Fig. 9. The plant of this variety is stocky, grows to a height of only about 2 feet, and is vigorous. The fruit grows to a larger size than that of any other variety, and is blocky, measuring about 5 inches

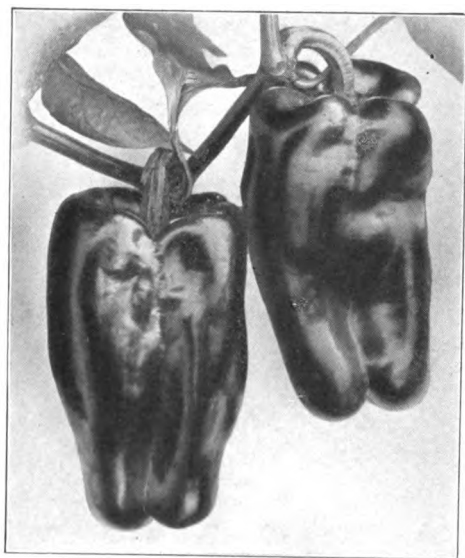


FIG. 8

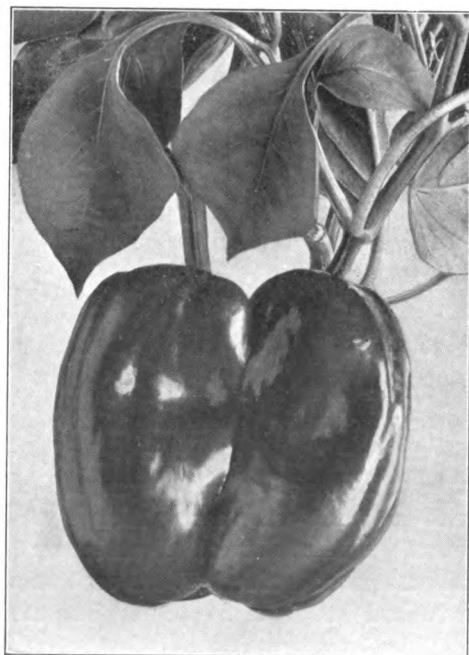


FIG. 9

both in length and in diameter at the stem end; the flesh is red, sweet, and very mild. This variety is popular on account of its large size, but most strains of it are light bearers

**61.** The **Squash**, or *Tomato*, pepper is a flat, somewhat tomato-shaped, thick-fleshed, mildly pungent pepper. It is early, very productive, and popular in many markets.

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#### SEED AND SEED PRODUCTION

**62.** Pepper seed may be successfully produced in any section of the country where the plants will grow well. Much of the commercial seed is grown in the South. It is perfectly feasible for any well-situated grower to produce his own seed. The usual principles of selection are applicable to this as well as to other crops. The plants bearing the earliest and the finest fruit should be saved for seed production.

If more than one variety of pepper is grown, the different varieties should be grown in fields as far apart as possible, so that cross-pollination will not take place. Cross-pollination of a sweet pepper with a hot pepper will ruin the quality of the sweet pepper. The plants are annuals and will produce seed in one season of growth. Sometimes, however, the seed will not fully mature before frost. In such a case, the peppers should be allowed to ripen as fully as the season will allow, and then the plants should be pulled up, root and all, just before they are likely to be hit by the frost, and hung up to dry in a place that is free from dampness, where the process of ripening will continue for some time.

**63.** When the fruit is ripe it should be opened and the center with its clinging mass of seeds should be placed in water. A considerable quantity of this pulp in a pail of water will soon set up a fermentation, which will decompose the vegetable matter around the seeds and render their separation easier. The fermentation should be allowed to continue for 2 or 3 days. Then the water should be drained off, the vegetable mass dried, and the seed rubbed free from the pulp. The seed should be well dried and stored in a dry place.

Some persons allow the plants to hang up in a drying room all through the winter, and do not separate the seed from the fruit and the inner pulp until just before planting time in the spring. Such a practice has its disadvantages. Decay is likely to set in on the fruit, and the seed is consequently more likely to become injured, and there is usually less time to devote to the separation of the seed in the spring, when all work is necessarily rushed, than during the late fall and winter months.

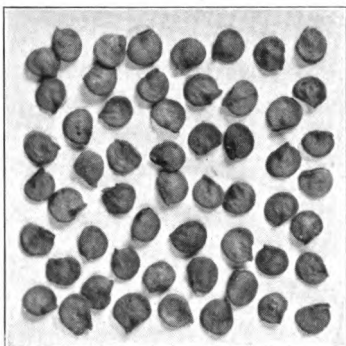


FIG. 10

**64.** Pepper seed is of medium size. About 4,250 to 4,500 weigh 1 ounce, and 1 quart weighs from 16 to 17½ ounces. A sample of Chinese Giant pepper seed is shown in actual size in Fig. 10.

Pepper seed retains its power of germination fairly well. The average period of satisfactory germination is about 4 years, and the extreme limit is about 7 years, but commercial growers usually prefer to use seed that is not more than 2 years old. To be considered high grade, pepper seed should be 98 to 99 per

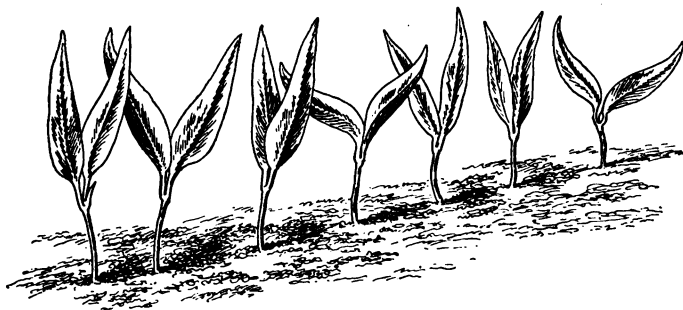


FIG 11

cent. pure, and about 85 to 90 per cent. of the seed should germinate; samples of seed from plants not grown under favorable climatic conditions may show a germination test of not

more than 65 per cent. Under favorable conditions, pepper seed should germinate in from 9 to 14 days. A few pepper seedlings are shown in natural size in Fig. 11.

About 4 ounces of pepper seed should produce enough plants to set 1 acre, and a small package of the seed should be sufficient to produce enough plants to set about 100 feet of row. The prices of the best hot pepper seed will range from about \$3 to \$4.50 a pound in pound lots; the best sweet pepper seed will sell at retail for from \$2 to \$6 a pound in pound lots.

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#### PLANT PRODUCTION

**65.** Pepper plants are produced under glass and then transplanted in the open very much like eggplants. As the earliest peppers command considerably higher prices than those that come into the market somewhat later, the importance of producing strong seedlings that will bear an extra-early crop is of prime importance.

The seed should be sown in the hotbed or in the greenhouse during February or early in March; in the South, this sowing is made early in February, and proportionately later farther North. In the South, pepper seed is sown outdoors during the latter part of March and the first part of April. The seed should be sown in rows about 6 inches apart and covered lightly with soil. To germinate the seed quickly and to maintain a rapid growth of the seedlings, a high temperature is necessary. One transplanting under glass will usually be sufficient. The plants should be handled in other respects as has been recommended for eggplants. When ready for transplanting to the field, the seedlings should be from 3 to 4 inches high.

From 1 ounce of good seed, about 2,000 to 3,000 or more satisfactory plants should be secured for transplanting.

### PLANTING AND GENERAL OPERATIONS

**66.** The soil should be prepared for peppers in about the same way as for eggplants; the surface should be well fined after the seeds are planted and all weeds subdued so as to give the seedlings full possession of the ground.

Frequently peppers are the second crop on a field in the spring. They are often grown after a crop of spinach, radishes, or green bunching onions. The preceding crop should not be allowed to delay the setting of the peppers.

**67.** Pepper plants are usually set in the field as early as possible without danger of their being injured by frost. This is because the earliest peppers in the market bring much higher prices than the second-early ones. In the latitude of New York, peppers are set in the open from May 15 to June 1, although many growers delay the setting until the latter date.

A moist, cloudy day should be selected for the work of transplanting, and the plants should be well supplied with water until they become well established; an overhead system of irrigation will be particularly serviceable for this purpose. In a home garden, the plants may be helped somewhat if they are shaded for an hour or so at midday for 3 or 4 days after they are transplanted, although commercially such a practice would obviously be impossible.

Pepper plants are usually set in the field in rows from  $2\frac{1}{2}$  to 3 feet apart, and are spaced from 18 to 24 inches apart in the row; the wider spacing is usually preferable. At these distances, from about 7,260 to about 11,600 plants will be required for setting 1 acre.

**68. Cultivation.**—Because they require large quantities of water and a soil free from weeds, peppers should be cultivated frequently. Such cultivation will stimulate a rapid growth, bring the peppers into the market early, and, in the case of sweet peppers, will tend to produce mild, sweet fruits; sweet peppers that receive insufficient water and that must struggle for a living will seldom be of good quality, but will develop more or less of the hot, pungent flavor of the hot varieties.

When the plants are heavily laden with fruit, ridging is sometimes practiced to help support them. This is particularly important in light soils, where the plants do not have a particularly good hold on the soil.

**69. Fertilization.**—As with many other vegetable crops, well-rotted stable manure gives better results on peppers than fresh stable manure. The application of manure to soils intended for peppers is important and beneficial, particularly because the soils usually devoted to peppers are light in texture and not naturally retentive of moisture. The best results are secured by applying the manure to the soil the previous year, however, especially if fresh manure must be applied.

The quantity of commercial fertilizer that will be required for peppers depends to a great extent on the quantity of stable manure applied; this also has an influence on the formula. If the land has received a good dressing of manure the previous season, from 500 to 800 pounds of a fertilizer, analyzing about 2 per cent. of nitrogen, 8 per cent. of phosphoric acid, and 8 per cent. of potash sown broadcast over the soil will pay. The application of too much nitrogen should be avoided, although a supply of this early in the season is necessary to get the plants started into a good growth. The phosphoric acid and potash are essential to induce abundant and early fruiting.

If little or no manure has been applied to the soil for at least a year before peppers are set, about 1,000 to 1,200 pounds of commercial fertilizer analyzing 4-8-8 should be applied; about 2 per cent. of the nitrogen should be in a soluble form, as nitrate of soda, and about 2 per cent. in an organic form such as dried blood or good tankage.

**70. Insect Pests and Injuries.**—There are no serious special insect pests or fungous diseases of peppers, and growers seldom attempt to prevent loss from these causes. Cutworms, however, will at times do serious damage on pepper plants. If cutworms are known to infest the soil, the plants should be protected with paper collars as described for tomato plants.

## HARVESTING AND MARKETING

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### HARVESTING

71. All peppers are green up to the time they reach maturity after which they turn red. When green peppers are required for market the fruits must be harvested early. The red peppers are harvested when the fruits are ripe. After they have reached maturity, that is, turned red, peppers will remain on the plants much longer than eggplants and tomatoes without deterioration. Hence, red peppers may be picked over a much greater length of time than green peppers.

In picking peppers, short stems should be allowed to remain on the fruits so that they will not dry out too soon. They may be most easily picked by turning them back on the stem, which will snap off an inch or so from the fruit.

The yields of peppers vary widely. Some varieties yield from 4 to 6 quarts per plant, but this is much above the average.

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### MARKETING

72. The bulk of the peppers sold by market gardeners, particularly the sweet sorts, are sold green, or before they are ripe. Peppers are handled in half-barrel baskets, in vegetable barrels, and in the different kinds of packages that are popular in various local markets. There is no standard unit of measure for peppers, but as the package serves as a basis for fixing the price, the variation in the size of packages makes it difficult to compare prices in different markets.

Sweet peppers usually find the most ready sale, and this kind should be grown by market gardeners who attempt to supply a general local trade. In small towns the demand for peppers will usually be light except just at pickling time. Of late years, the demand for peppers, even at pickling time, however, is less than formerly, because less pickling is now done at home and greater dependence is placed on cannery pickles.

In towns and cities where a large proportion of the population consists of persons from Southern Europe, a special trade can sometimes be built up on certain varieties of peppers, because persons from that part of the world are particularly fond of peppers. The varieties that can be sold to best advantage to those persons, however, will vary in different localities. Careful inquiry should be made in the market as to which kinds are in the greatest demand, and only these kinds should be planted.

**73.** Peppers are not as perishable as many vegetables, and as they do not have to be sold as soon as received, prices are not periodically depressed as much as for some vegetables. During the height of the season, however, the large supply of peppers sent to market makes them much cheaper than at other times.

As with other vegetables, the prices of peppers show wide variations in almost every month in the year. An examination of the wholesale prices of peppers in the New York markets for the 10 years from 1903 to 1912, inclusive, shows that the variations in the same month are often several hundred per cent. The top-notch prices and the highest average prices are naturally secured in this market during cold weather, when the supply must be shipped in from a great distance.

**74.** Peppers are found in the New York markets every month in the year, and are usually sold by the carrier holding about  $\frac{1}{3}$  barrel, although from August to November they are to some extent also sold by the barrel. The highest average prices are secured in February. From then on good prices are secured, but there is a decline in price until June, when the price shows some increase because of the increase in demand and the scarcity in the market. During the summer and fall months the prices are low. In December and January the prices pick up and are nearly as high as in February. As the most profit can be secured only by selling when prices are high, those growers who can send peppers to market during the cold weather will have the advantage of those who cannot. Many growers who can raise peppers for sale only in the summer and fall may be able to do better by raising other products.

75. In Table II is shown for each month the extreme low and high prices and the average low and high prices per carrier and per barrel for peppers in the New York markets for the 10 years from 1903 to 1912, inclusive. These prices are figured from the average low and high prices on the first and fifteenth of each month for the decade in question. The prices in the

**TABLE II**  
**PRICES OF PEPPERS IN THE NEW YORK MARKETS**

Month	Per Carrier				Per Barrel			
	Extreme Prices		Average Prices		Extreme Prices		Average Prices	
	Low	High	Low	High	Low	High	Low	High
January.....	\$0.50	\$7.00	\$1.43	\$3.50				
February.....	.50	7.50	1.45	3.65				
March.....	.50	6.00	1.18	3.25				
April.....	.50	3.50	.95	2.60				
May.....	.75	3.00	.95	2.28				
June.....	.75	3.00	1.13	2.30				
July.....	.50	2.50	.83	1.75				
August.....	.25	1.00	.53	.90	\$0.50	\$2.00	\$0.70	\$1.55
September.....					.35	2.00	.56	1.38
October.....	*.50	1.25			.25	2.00	.56	1.47
November.....	.50	2.25	1.03	1.38	*.35	1.75		
December.....	.50	8.00	1.30	3.53				

\*Quotations in the month only once during the 10-year period.

New York markets are considered in detail, because these markets are the largest in the country, and the prices there may be considered as fairly representative.

In many of the small local markets along the Atlantic seaboard, peppers will bring from 25 cents to \$3 a bushel, according to the variety and the market..



# CUCUMBERS AND SQUASHES

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## CUCUMBERS

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### GENERAL REMARKS

1. The **cucumber** is one of the oldest of the cultivated garden vegetables and is usually considered to have come originally from the southern part of Asia; records are in existence telling of its culture in India more than 3,000 years ago. The vegetable was first grown in England in the latter part of the 16th century, and it was brought to America by some of the first English settlers.

In the United States, the cucumber is largely grown as a field crop and to a less extent as a truck-, market-garden, and greenhouse crop. The cucumbers that are grown in the field are largely used for pickling, and the others are largely used for slicing and eating fresh. In the South, the cucumber is considered to be one of the most important as well as one of the most profitable of the trucking crops. In the North, the bulk of the crop is grown for pickling, but a considerable quantity is also grown in the market gardens and greenhouses for use fresh. In the North, the culture of cucumbers under glass has grown to be an important industry, and the production is increasing nearly every year. Cucumbers are now one of the three most important greenhouse crops, the other two being lettuce and tomatoes. The cucumbers from the greenhouses and from the Southern trucking farms appear in the markets of the northern sections of the country as soon as the vines that have been producing the outdoor crop in

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those localities have been killed by frost. This out-of-season supply holds its place in the markets for nearly 9 months in the year, and the demand is usually sufficient during this time to keep prices attractively high for the grower.

**2.** Cucumbers are commonly considered to be somewhat of a luxury and in a fresh state are not used by the majority of persons except during the summer, when they are low in price. The fruits are extensively used for pickles, and the fresh fruit is sliced and eaten with various kinds of dressings. To a limited extent, the cucumber is also used in cooking.

**3. Commercial Importance.**—The cucumber crop is of considerable commercial importance. According to the census, the total value of the crop produced in the United States in 1909, was \$2,719,340, produced on 32,310 acres, distributed among 16,714 farms; this shows an average of 1.93 acres per farm. These figures include only the commercial crop, or that grown in patches of 1 acre or more.

Cucumbers are grown commercially in almost every state. The ten principal states, ranking in the order of the value of the crop produced, are: Florida, Michigan, New York, Illinois, Massachusetts, Virginia, New Jersey, South Carolina, Ohio, and Indiana. These states produce more than 76 per cent. of the total crop; Florida alone produces about 13 per cent.

The average income per acre from cucumbers for the United States is about \$84, but the average incomes for the different states vary widely, being as follows: Massachusetts, \$481; Florida, \$170; Ohio, \$125; South Carolina, \$119; New York, \$100; Virginia, \$100; Illinois, \$78; New Jersey, \$73; Indiana, \$53; and Michigan, \$48. The reasons of the high average income per acre in Massachusetts is because in that state cucumbers are grown intensively and sold almost entirely for slicing. Many growers in the other states, of course, secure much higher incomes per acre than those given for the state.

**4. Cost of Production and Returns.**—The cost of production of 1 acre of cucumbers varies with the management, local climatic and soil conditions, and the prevalence of insect pests and diseases. The following estimates of the cost of

producing 1 acre of cucumbers for slicing have been made by a prominent market gardener, and presuppose that the land is in a good state of cultivation before the crop is attempted:

	MODERATE ESTIMATE	LIBERAL ESTIMATE
Use of land.....	\$ 5.00	\$ 10.00
Preparation of land, plowing, and har- rowing.....	5.00	10.00
Stable manure and commercial fertilizer	25.00	40.00
Seed.....	2.00	10.00
Seeding.....	1.50	5.00
Thinning.....	1.00	3.00
Spraying (about six times).....	9.00	18.00
Cultivation and hoeing.....	8.00	15.00
Harvesting and marketing.....	40.00	65.00
Total.....	\$96.50	\$176.00

The figures on harvesting and marketing will vary widely with the distance of the grower from market, whether he carts his own crop to market or must ship it, and the selling charges in the market. Cucumbers are rather perishable, and the loss in long shipments may be considerable.

5. The gross returns from 1 acre of cucumbers vary with the yield and with the selling price. When the hills are spaced 4 feet by 6 feet, and two plants are grown in each hill, there will be about 1,900 hills, or about 3,800 plants per acre if the stand is perfect. Under good cultivation, the yield per plant will vary from five to twenty or more marketable fruits per vine. An average yield of fifteen marketable fruits per vine is not unusual, giving about 50,000 fruits per acre; about eighty of the larger fruits will make 1 bushel; this will give a yield of about 625 bushels per acre; yields of from 200 to 400 bushels are common among good growers. For outdoor-grown cucumbers, average prices between about 25 cents to \$1.50 a bushel are secured, according to earliness and quality.

The net returns vary with the cost of production and of marketing, both of which items must be deducted from the gross returns.

**6. Climatic Requirements.**—The cucumber and all members of the same family are of a subtropical nature and require plenty of heat and sunshine. They are all very susceptible to injury from frost, and for this reason the season in the North is short, because the seed cannot be planted in the open until all danger from frost is past. These plants will not make a satisfactory growth in cold, cloudy weather.

**7. Soils.**—Cucumbers can be grown on a number of kinds of soil, but the commercial production of the crop should not be undertaken except on exceptionally favorable soils. One of the most necessary requirements of a soil for cucumbers is that it have a large water-holding capacity. A soil for cucumbers should also be well drained.

The best results with cucumbers are commonly secured on a properly-drained, well-enriched light loam soil. Gravelly soils and stony soils that are well supplied with plant-food can also often be made to yield abundant crops of cucumbers; good results can be secured on a stony soil, but the stones should not be so numerous as to interfere with the cultivation of the crop. Most light sandy soils that are deficient in humus will produce small yields of cucumbers unless the rainfall happens to be heavy during the growing season. On the other hand, many heavy clay soils are wholly unsuitable for cucumbers in a wet season, because such soils become very compact from the tramping they receive during the necessary successive pickings. Many heavy clay soils can be made fairly suitable for cucumber culture by supplying them with an abundance of organic matter and draining them by tile drains.

A clover or timothy sod that is not badly infested with cutworms and is plowed early in the spring and well harrowed until seeding time makes a good seed-bed for cucumbers.

## VARIETIES, SEED, AND SEED PRODUCTION

### VARIETIES

8. Market cucumbers may be divided into three classes: (1) *English forcing* cucumbers; (2) *white spine* cucumbers; and (3) *black spine* cucumbers.

9. **English Forcing Cucumbers.**—The English forcing cucumbers are largely grown under glass. The fruits are long, averaging from 12 to 18 inches, taper toward the ends, are

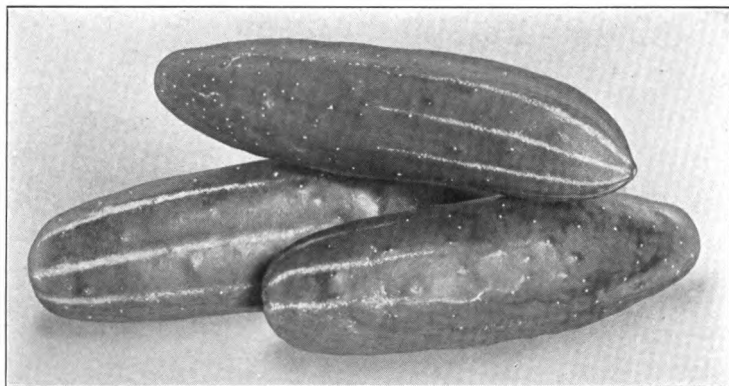


FIG. 1

slender, have a dark-green skin without spines, and contain few seeds. It is a curious fact that fertilization of the blossoms is not essential to the setting of the fruits. The Telegraph is one of the most prominent varieties of the English forcing class. The cucumbers of this class meet with some favor in high-class markets, where they sell in small quantities at several times the price of the common kinds. The quality is good, but the varieties of this class are not suitable for outdoor culture, and neither do they produce as abundantly as the varieties of the white-spine class. There is little likelihood that the English forcing cucumbers will ever become generally popular in the United States. The best use for them in

America has been in plant breeding. The plant breeder has been able to combine some of their excellent qualities with those of the white spine cucumbers, and to produce superior hybrids, some of which are good for market purposes. The **Woodruff Hybrid** cucumber, specimens of which are shown in Fig. 1, is one of the best of the cucumbers that has been produced by a combination of English forcing and American standard varieties; this is of comparatively recent origin, and is gaining rapidly in popularity.

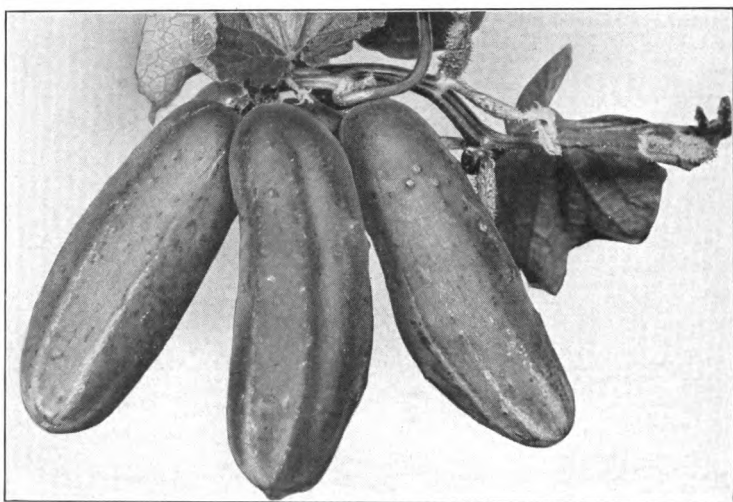


FIG. 2

**10. White Spine Cucumbers.**—The white spine cucumbers include all of the important field varieties grown in the United States. Until recently the cucumbers of this class were the only ones grown for slicing, but now some of the hybrids, like the Woodruff Hybrid, are being grown to a certain extent. Some of the varieties of the old white spine cucumbers excel in earliness and are likely to be extensively produced for some time to come at least.

Specimens of the original **White Spine** cucumber are shown in Fig. 2. The typical fruit of this variety when mature for market is from 6 to 8 inches long, about 2 to 2½ inches in

diameter, or about one-third as thick as it is long, and is somewhat ribbed. The fruit is more or less closely dotted with white spines, which are spaced somewhat more closely in the middle portion than on the ends. The skin is of a dark-green color at the stem end, shading to a lighter color at the blossom end; the fruits of different strains are more or less striped with lighter green at regular intervals for one-third to one-half of the distance from the blossom end toward the stem end, the distance varying with the strain. The vines of a good strain are prolific and grow fairly thick. The yield from the vines of a good strain should not be less than sixteen to twenty fruits to the plant.

**11. The Early White Spine Cucumber** is one of the earliest of the white spine class, and has the same general shape as the White Spine. The fruits average about 6 inches long and about 2 inches in diameter, are of a light-green color, have comparatively few spines, and are of good quality. The vine grows vigorously, is prolific, and bears early.

**12. The Arlington White Spine** cucumber has been produced by selection from the Early White Spine for the purpose of securing an early cucumber that was longer, of a darker green color, and more pointed at the ends. Fruits of good strains of the Arlington White Spine vary from 7 to 9 inches in length, are about 2 inches in diameter, of a considerably darker green than those of the Early White Spine, and retain their dark-green color longer on the vine.

**13.** In addition to those just mentioned, there is also a large number of varietal names applied to different strains and to the same strain of white spine cucumbers. Some of the more common of these are the **Improved White Spine**, the **Selected White Spine**, and the **Extra-Long Perfected White Spine**. The value of seed offered under such names can be judged only by the character and reputation of the seedsman offering them.

**14.** The **Davis Perfect** cucumber has been produced by selection from the White Spine, and probably by crossing with

an English variety. It has met with much favor since its introduction. The fruit measures from 7 to 9 inches long, and tapers distinctly toward the stem end like the fruits of the English varieties. The skin is dark green, and the spines are few in number. This variety is not as prolific as some of the white spine varieties, but is a very satisfactory market variety.

**15. Black Spine Cucumbers.**—The black spine cucumbers include the more important of the varieties that are

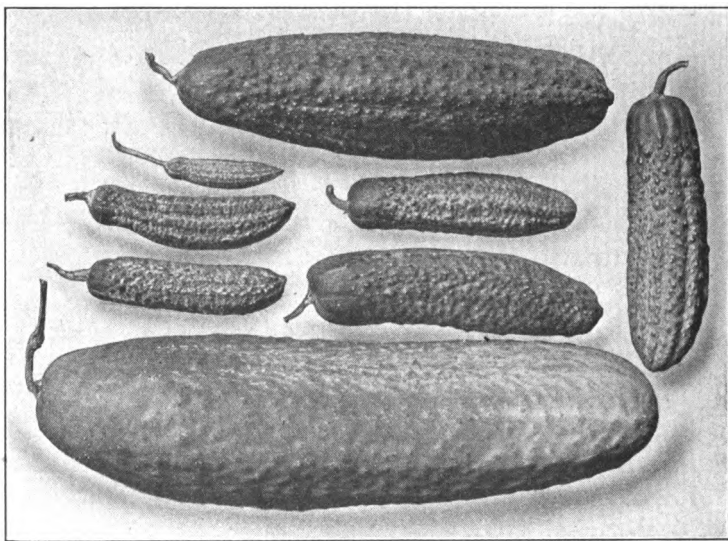


FIG. 3

grown for the production of pickling cucumbers. The smaller cucumbers that are used for pickles are sometimes called *gherkins*. The most important pickling varieties are the **Early Cluster**, the **Boston Pickling**, the **Snow Pickling**, and the **Cumberland**. In Fig. 3 are shown Cumberland cucumbers at various stages of development; the different sizes are used for various grades of pickles.

There are some black spine varieties that are grown for slicing cucumbers, but they do not sell readily and are not considered to be important for this purpose.

**SEED AND SEED PRODUCTION**

16. Cucumber seed can be successfully produced in almost any locality where the crop will do well, and for this reason the bulk of the cucumber seed used in the United States is grown locally. When the proper care and attention is given, the home production of cucumber seed is comparatively simple and easy.

Before selecting plants for the production of seed the ideal type of the cucumbers of the variety in question should be firmly fixed in the mind. An examination of the illustrations of varieties will assist in this matter and in addition a large number of plants should be studied in the field. In selecting ideal cucumbers it should be borne in mind that the productivity of a vine and the character of all of its fruits are points of greater importance than the character of any individual fruit; the earliness of bearing is also of fundamental importance, and the seed should be saved only from the fruits that mature earliest. All of the fruits on a vine should be of good shape and color for the variety.

17. When a plant has been selected for seed production it should be carefully marked and should never be allowed to bear more than a few fruits. The marking can be done with a strong stake that cannot be easily knocked over. Not more than three or four fruits should be allowed to mature on the vine; all others should be picked off before they reach any great size. To prevent pickers from accidentally removing fruits that are being saved for seed purposes a piece of cloth or a tag should be loosely tied about the stem close to each seed cucumber.

18. Seed cucumbers should be allowed to mature fully. When well ripened, a cucumber will be yellow, will be from two to three times the usual market size, and, if not bruised or diseased, it will keep for some time without deterioration. The usual practice is to leave the seed cucumbers on the vines until late in the season, frequently until after the bulk of the

market crop has been harvested. They are then gathered, piled, and opened before decay sets in.

The seeds are removed by slicing the cucumber lengthwise and scraping out the seed and the pulp surrounding them in the seed cavity. This mass of pulp containing the seed is put in water and allowed to ferment slightly, or until the pulp will separate readily from the seeds in washing. The washing may be done over a screen or in a pail or vat, the pulp and light seeds being washed through the screen. The seeds are then dried—preferably sun-dried—rubbed clean, and stored in a dry, vermin-proof place.

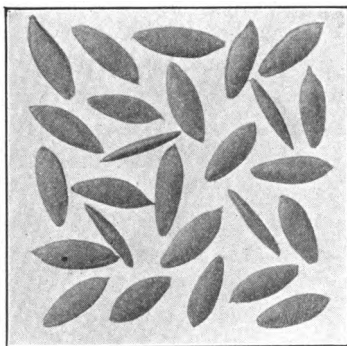


FIG. 4

Cucumber seed may be dry cleaned by drying the pulp and seeds and then rubbing the seeds clean between the hands. This method is much more laborious than that previously described, and does not give any better results.

Paper bags are satisfactory for the storage of cucumber seed, if they are placed in a suitable storage place where

mice and rats cannot get at them.

**19.** When cultivated for seed purposes alone, the yield of cucumber seed varies from 150 to 500 pounds per acre, and the price varies from about 50 cents to \$1.25 a pound, according to the variety and the skill and reputation of the grower.

**20.** A sample of cucumber seed is shown actual size in Fig. 4. Of the common kinds of cucumber seed, which includes seed like those just mentioned, about 925 are required to weigh 1 ounce; of the globe cucumber seed, which are much smaller, about 2,835 are required to weigh 1 ounce. On an average, 1 quart of common cucumber seed weighs a little more than 19 ounces.

**21.** Cucumber seed is fairly long lived. On an average, it will retain its power of germination for 4 or 5 years; the

extreme limit is more than 10 years; however, cucumber seed will not retain its vitality that long unless kept under ideal conditions, and hence the use of seed more than 2 years old is seldom advisable. To be considered of high grade, cucumber seed should be about 99 per cent. pure and about 96 per cent. of it should germinate. The time required for the germination of cucumber seed varies with the surrounding conditions from 4 to 20 days; under good conditions, it should germinate in

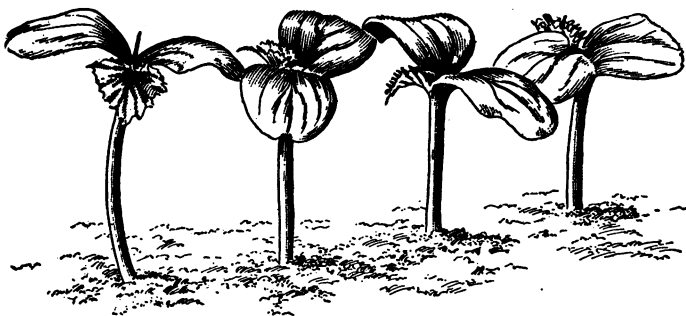


FIG. 5

from 6 to 10 days. Cucumber seedlings are shown natural size in Fig. 5.

22. At the usual distances of planting, that is with hills 4 to 5 feet apart each way, and sowing six to twelve seeds in a hill, from 1 to 3 pounds, usually about 2 pounds, of cucumber seed will be required for sowing 1 acre; about  $\frac{1}{2}$  ounce will be required for planting 100 feet of row. From reliable seed houses cucumber seed retails at from \$1 to \$2 a pound in pound lots.

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## PLANTING AND GENERAL OPERATIONS

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### PLANTING

23. In different sections in the latitude of New York City, cucumber seed is planted in the open from May 5 to about June 15, with a reasonable expectation that the plants will not be killed by frost; the pickling crop is usually planted in June. In the cucumber sections of Michigan, the plantings are made

during the latter part of May. In the trucking section about Norfolk, Virginia, cucumbers are planted in April. In Georgia, cucumbers are planted from about March 1 to 15.

In no locality should cucumbers be exposed in the open until all danger from frost is past or the loss may be severe; also, the ground should be fairly well warmed up so that the plants will get a good start. Early planting, that is, as early as practicable, is, however, very desirable, because the largest yields are secured from such plantings, provided the plants are not injured by frost or by insect pests and diseases.

24. Some growers who produce cucumbers on a large scale plant the seed at two different depths in each hill for the purpose of securing as early a crop as possible with the minimum of risk. The seedlings from the shallower planting naturally come up first. If they are uninjured by frosts, etc., they are allowed to develop and the second lot of seedlings that come up are pulled out. If those of the first lot are killed by frost or by insects, those of the second lot commonly come on late enough to avoid at least frost injury.

Other growers commonly make successive sowings of cucumber seed, from 10 days to 2 weeks apart on different pieces of land. In this way, some of the sowings are sure to develop productive plants, and if all of the plants survive the early spring weather there will be a good succession of crops for market.

25. In some cases, especially in localities where the late spring is particularly frosty, no attempt is made to secure an extra-early stand of cucumber plants. Frequently, the cucumbers are made a succession crop, following set beets, or transplanted beets, on the ground. When this is done, the ground is set with beet seedlings shortly after it is fitted, manured, and fertilized in the spring. The rows of beets are spaced 1 foot apart and every sixth row is omitted. Spinach also is sometimes used as a companion crop; the seed of this is sown directly in the field. At the proper time, the cucumber seed is planted at the desired distances in the vacant spaces, and the vegetables in the rows between the cucumber hills are removed as rapidly as the cucumbers require the space.

An early crop of cucumbers can sometimes be secured by growing the young plants with a companion crop of some kind that will protect them. A companion crop is probably of most use in protecting the young cucumber plants from cold winds; cucumber plants are of a semi-tropical nature, and cold winds will greatly retard their growth. Bush beans planted in alternate rows with cucumbers afford excellent protection from winds and are probably the most convenient companion crop to handle. Some growers use rye as a companion crop. The rye is sown in the fall. In the spring, strips are plowed out and harrowed; these are made of convenient width, and the cucumbers are planted in them at the required spaces. The remaining strips of rye are then cut and the entire area between the cucumbers cultivated later in the season, after no further protection is needed for the cucumber vines.

**26.** Cucumbers are planted both in hills and in drills. The oldest method of planting is in hills, and this is still followed by the great majority of growers. One important advantage of planting in hills, provided, of course, that the hills are planted in check rows so that the passageways between the rows are straight, is that the cultivators can be worked both ways across the field; this materially reduces the expense necessary for hand hoeing.

The distances apart for spacing the hills depends on the condition of the soil. In fertile soils, the hills should not be spaced less than 5 feet by 5 feet, which allows about 1,740 hills per acre. In good soils, many growers claim that they get better results by spacing the hills 6 feet by 6 feet, or planting about 1,210 hills per acre. In light soils of moderate fertility, the hills are often spaced 4 feet by 5 feet, or about 2,180 hills per acre.

The best results in hill planting are commonly secured by placing a forkful of stable manure in each hill and mixing it well with the soil. If manure has been broadcasted over the soil before planting, the placing of this manure in each hill may not be necessary, although it will almost always produce better results, except perhaps on particularly rich soils. The

manure used in the hills is most effective if well rotted, and should be well worked into the soil, so that the seed will not rest directly on it.

27. Cucumber seed can be most satisfactorily planted in hills only by hand, and it is commonly planted in that way. A depression from  $\frac{1}{2}$  to 1 inch deep and from 8 to 10 inches across is scraped in the loose soil with the foot or with a hoe at the point where the hill is to be planted, and from eight to fifteen seeds scattered over it; seed should be freely used in this and in all systems of planting so that there will be a number of plants to select from when thinning and so that the insects will not be likely to destroy all those in a hill; the surplus plants can be easily chopped out with a hoe or pulled out. The seed in the hill is covered by throwing some loose soil over it and stamping on it; this is necessary to restore the capillarity of the soil and to provide sufficient moisture for germination. Lastly, a thin covering of soil is kicked over the hill to act as a dust mulch over the firmed soil. It is usually found to be quicker and fully as satisfactory to use the foot for making the depressions and covering the seed as any hand implement.

When seed is planted at two different depths in the same hill, as previously mentioned, for the purpose of securing a succession of plants, and to allow for those that may be damaged by frost or insects, the first lot of seed is planted about  $1\frac{1}{2}$  inches deep, covered, as just described, with about  $\frac{1}{2}$  inch of soil, and then a second lot planted above this as if the first lot were not there.

In a properly prepared seed-bed, much less time is required for the whole operation of planting a hill than it takes to tell about it.

28. The planting of cucumbers in drills has become popular in some of the trucking sections, notably in that around Norfolk, Virginia, within the last few years. The advantages claimed for this system are: (1) The individual plants are able to reach a more perfect development on account of having more room; (2) the vines and roots are less crowded for space than in the hill; and (3) a power sprayer can be used to better

advantage on plants in rows than on those in hills. The disadvantage of the system is that more labor is required for hand hoeing; this is a particularly important point to consider if the land is weedy.

When the drill system of planting is followed, the seed is sown with a seed drill. The rows are spaced 4, 5, or 6 feet apart, according to the fertility of the soil, and after the seedlings come up they are thinned to stand about 12 inches apart in the row. When the rows are 4 feet apart this will give about 10,890 plants per acre; when 5 feet apart, about 8,710 plants; and when 6 feet apart, about 7,260 plants. When cucumbers are planted in hills, usually about four plants are left in a hill; hence, planting in drills permits of putting in a much larger number of plants per acre.

The thickness of seeding in drill planting will depend somewhat on the quality of the seed. Good seed that shows a germination test of better than 90 per cent. should be planted about three or four to the foot. This will insure a good stand of plants and allow a liberal number from which to select when thinning. Seed that will not show such a good germination test should be sown proportionately thicker, or perhaps should not be sown at all.

**29.** Because the earliest cucumbers normally bring the highest prices in the markets, an effort is often made to start the plants under cover before they can be safely grown outdoors. To get an extra-early crop the plants are sometimes started under cover in their permanent positions in the field, and sometimes they are started in hotbeds or greenhouses.

When plants are started early in the field, a forcing-hill frame may be used to cover each hill. The expense of covering a large field with such frames, however, is considerable, and hence the following method of protecting the plants, which is much cheaper, is often practiced:

A forkful of heating manure is put in each hill and covered with from 2 to 3 inches of soil. This covering will prevent injury to the seeds from excessive heat, and the heat produced by the manure will make the soil warm enough for cucumbers

long before it could be brought to the same condition by the heat of the sun. As soon as the seeds are planted above the manure, the soil is banked up 3 or 4 inches on the north, east, and west sides of the hill, the south side being left level, and a pane of glass is laid over the hill as shown in Fig. 6. The glass should be embedded somewhat in the banks of soil so that the wind will not blow it off. This makes a miniature hotbed that will prove effective in most cases. Even with this protection, however, cucumber seed should not be planted in the latitude of New York City before May 1, because growth of the vine is so rapid that it would soon become crowded for space and its growth would be seriously checked before the glass could be safely removed.

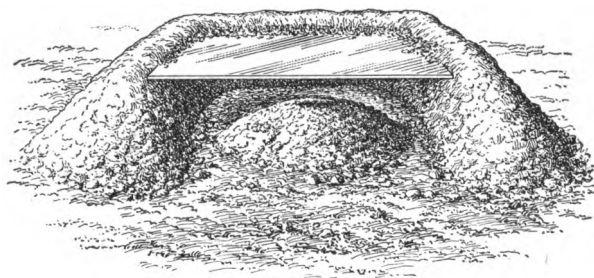


FIG. 6

When such an improvised hotbed is to be used, a large number of seed should be planted in a hill, for the same reasons as when they are planted in the open. It will almost always be necessary to thin the seedlings when they have become well established. Not more than three should be left in a hill.

**30.** On account of the greater certainty with which the temperature may be controlled, a greenhouse will be found most suitable for the production of early cucumber plants indoors, although hotbeds, and even cold frames with glass and cloth-covered frames will answer well for this purpose when they are properly handled. When grown commercially, the plants can be most economically produced in pots, and usually paper pots will be found to be preferable. Pots not less than 4 inches

in diameter should be used. Berry baskets and other receptacles can be used in lieu of pots.

About 1 inch of well-rotted stable manure should be placed in the bottom of each pot, and the rest of the space filled up with rich, light, porous compost. Under no circumstances should soil that has a tendency to bake be placed in the pots. From six to eight seeds should be sown in each pot and covered either with clean sand or with a mixture of sand and leaf mold. After the seedlings have attained a height of 3 or 4 inches they should be thinned out to the two or four best ones of the lot. It is common to leave two seedlings to a pot, but some growers claim that expense can be saved by allowing four to remain and by spacing the plants in the field farther apart. By this plan, the saving is in not having to grow so many potfuls to set 1 acre; but four plants in a hill will not do as well as two, and under average conditions two are to be recommended.

**31.** Formerly, the general custom was to raise cucumber plants for the early crop on inverted sods, and this practice is still followed to a certain extent, but as the labor expense is generally considerably more than when paper pots are used, the practice is going out of favor. The growers who still follow the method claim they can produce much better plants in this way, because the cucumber seedlings find their most congenial home in a sod.

The sods are usually cut in long strips from an old pasture or other field and are laid inverted and placed close together on greenhouse benches or in hotbed frames. They are then cut into squares, usually 6-inch squares, but sometimes into 3-inch or 4-inch squares, which are slightly hollowed out to hold the seeds; the seeds are planted in the depression, and covered lightly with either clean sand or a mixture of sand and leaf mold. The sods should be frequently watered so as to provide plenty of moisture for the germination of the seeds, because water drains out of them quickly. Cucumber seedlings on an inverted sod and at the proper stage for transplanting are shown in Fig. 7.

The number of pots or of inverted sods that will be required to produce enough plants for 1 acre will depend on the distances at which the hills are to be spaced. As previously mentioned, the number of potfuls is sometimes lessened by growing four plants in each pot, and the same plan can be followed with sod. When the hills are spaced 4 feet by 4 feet, about 2,722 potfuls of plants will be required for 1 acre; when the hills are spaced 5 feet by 5 feet, about 1,742 potfuls will be required; and when the hills are spaced 6 feet by 6 feet, about 1,210 potfuls will be required. Some growers prefer to space the early plants 2 feet by 4 feet, in which case only two seedlings would be left in a pot and about 5,445 pots would be

required to plant 1 acre.

On an average, a hotbed frame measuring 3 feet by 6 feet will accommodate about 172 4-inch pots, so that ten hotbed frames of this size will commonly grow enough plants to set 1 acre.

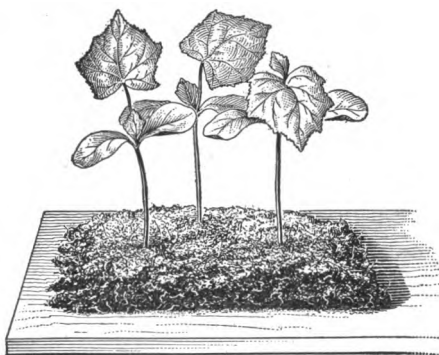


FIG. 7

be sown about 1 month before the plants are required for setting in the field. In the latitude of New York City this will be about the middle of April. The seed should not be sown too long before the plants are required for field setting, because the plants will receive a severe check from which they may never recover if they are too large when transplanted.

For the first few days after the seed is sown the sash over the frame should be kept down so as to maintain a high temperature which assists in germination. After the seedlings begin to appear, the temperature at night should be kept at about 60° F., and during the day from 70° to 90° F. During the few days preceding the transplanting, the cucumber seedlings should

be hardened off somewhat by giving them only a moderate supply of water and free ventilation. If the plants are not hardened off, they will usually get such a shock by being transplanted that much of the time gained by starting them under glass will be lost.

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#### PICKLE PRODUCTION

**33.** When cucumbers are grown for pickles they are produced in the same way as those grown for slicing, but the varieties are different and vary in different localities. Cucumbers intended for pickles are raised on large areas and they do not receive the same care as those intended for slicing. Cucumbers for pickles are usually grown near a pickling establishment, and the crop is generally contracted for before it is planted.

Pickling cucumbers are sold by the hundred, the thousand, or the ton, according to the grade. There are a number of grades, several of which are illustrated in Fig. 3.

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#### FERTILIZATION

**34.** Large yields of cucumbers of fine quality can be secured only when the vines have a continuous, unchecked growth throughout the season. For sustaining such a growth, proper fertilization is of the utmost importance, although due attention must also be paid to cultivation and other details.

Cucumbers do particularly well in soils containing an abundance of humus; the roots of the plants are able to penetrate such soils very easily and seem to be able to secure large quantities of plant-food. Well-rotted stable manure is the best material for supplying humus in a soil. Fresh stable manure should be applied to the soil only the previous year.

The method of applying stable manure to a soil depends on the quantity available. On market gardens, where there is commonly an abundance of this material, it is applied broadcast and plowed under. On truck farms, where stable manure is expensive and often difficult to get at all, a small quantity is spaded into each hill, or it is applied in trenches. The

method of applying it in trenches is very satisfactory on many truck farms. About 1 month before the planting time for cucumbers, deep furrows are opened up along the rows where the hills are to be placed; the manure, preferably well rotted, is spread in these furrows, or trenches, and soil thrown over it by plowing back the soil that was previously thrown out of the trench; deep-working cultivators are then run along over the trenches, and the soil and manure are well mixed.

**35.** Most commercial growers find it necessary to use commercial fertilizers in addition to manure. The kind and quantity of commercial fertilizer to apply depends on the quantity of manure previously applied or on the general tilth and fertility of the soil. The application of too much nitrogen should be avoided, because an excess will stimulate vine growth at the expense of fruit; a certain quantity of nitrogen, however, is essential to give the vines a good start. Liberal quantities of phosphoric acid and potash should be applied in order to stimulate large yields of fruit. If the land has been heavily manured, from 1,000 to 1,500 pounds of a fertilizer analyzing 2 per cent. of nitrogen, 8 per cent. of phosphoric acid, and 10 per cent. of potash will usually be ample. Where cover crops have been used, or where only a small quantity of manure is available, about 2,000 pounds of a fertilizer analyzing 4 per cent. of nitrogen, 8 per cent. of phosphoric acid, and 10 per cent. of potash can commonly be applied to advantage.

If the soil is in a high state of cultivation, the commercial fertilizer is usually applied broadcast before planting time. If the fertility is not high, the fertilizer is usually mixed in the hills. Some growers prefer to apply the fertilizer in fractional quantities. Usually no advantage is gained by such a practice, and on some of the poorer soils light applications of nitrate of soda are sometimes effective. Unless judiciously made, however, nitrate of soda may diminish the yield by overstimulating vine growth late in the season.

**CUCUMBER PRODUCTION IN A HOTBED**

**36.** If grown at a time when fancy prices can be secured, cucumbers can be profitably produced in hotbeds. In the latitude of New York City, the seed should be planted from the middle to the latter part of March, and the crop will be ready for market about the last of May; the cucumbers can be harvested as long as the vines can be kept healthy.

When cucumbers are grown in a hotbed, two hills are commonly planted under each sash, one in the center of each half. Double cropping may be practiced to advantage in such a case, cabbage and lettuce plants being so spaced in the frames that room will be left for the development of the cucumber vines while they are young.

The method of management of the plants in the frames is about the same as for the production of early plants for field planting. The temperature should be closely watched and should not be allowed to go above 70° F., except on bright, sunshiny days, when it may go considerably higher than this. The plants should never be watered so much that the ground will become soggy and the air in the frame will become oversaturated with moisture, because such conditions are favorable to the spread of fungous diseases.

The thick planting of cucumber seed in a hill is necessary, so that if insects do much damage there will likely be some left over; out of a dozen or more plants a few at least should remain undamaged. After the seedlings are well up but before the vines begin to run, the plants in each hill should be thinned to about four of the best to a hill. A second thinning should be made in about 1 week or 10 days, when two more should be taken out and only the two strongest seedlings allowed to remain. By this time the danger of destruction by the cucumber beetle will be small, and the plants will be large enough to make it unlikely that they will die of other causes.

## INSECT PESTS AND INJURIES

## INSECT PESTS

37. The **striped cucumber beetle**, shown in Fig. 8, ranks as one of the most persistent and troublesome of insect pests, and it causes considerable damage to cucumbers. The beetle appears in the spring, in April and May, or about as soon as cucumber seedlings have developed the first pair of leaves, and feeds voraciously on the lower sides of the leaves and at the terminal buds. It lays eggs near the base of the plant.

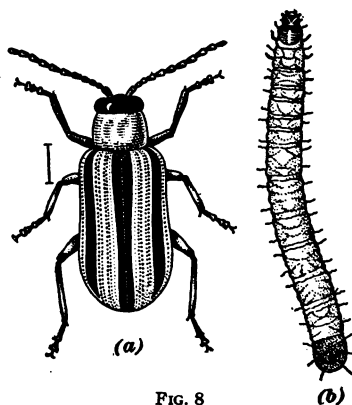


FIG. 8

The larva, which is a small white worm, hatches and crawls to the stem of the plant, on which it feeds; it also sometimes damages severely the roots. The damage done by larvae is often so severe as to cause plants to wilt and die. The larva completes its growth in about 2 months; it then pupates, and when the mature insect emerges from the pupal stage it seeks a hiding place and protection from the low temperatures

of winter in some rubbish pile, where it remains until spring.

The mature striped cucumber beetle measures about  $\frac{1}{4}$  inch long and is about one-third as wide as it is long. Its back is marked with alternate yellow and black stripes. The larva is about  $\frac{3}{16}$  inch long and very slender; its body is white and it has a brown head. This insect is a native of the eastern United States, is found in all localities in this section, to some extent in all the rest of the country east of the Rocky Mountains, and also in Washington.

38. The control of the striped cucumber beetle is very difficult. Poisons have not proved effective and it is necessary

either to use some repellent or to employ preventive measures. Tobacco dust and hydrated lime sprinkled on the plants act as repellents, but unfortunately it is difficult to apply them to the under portion of the leaves, the part on which the insects feed. The lime will be more effective as a repellent if immediately before it is applied just enough carbolic acid is added to it to give it an odor.

The most certain way of avoiding damage from this insect pest is to screen the plants until they are well started, but this requires a lot of labor and is expensive on a large field. A suitable screen for covering a single plant can be made by

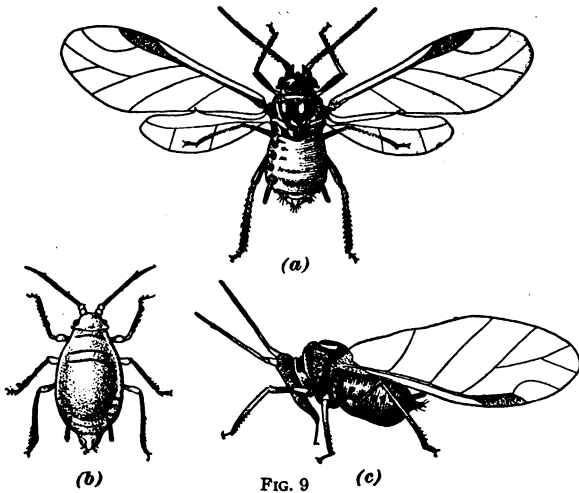


FIG. 9

fastening light cloth mosquito netting to a small barrel hoop; if this is dropped over a plant it will effectively prevent the attack of the beetles. When the plant has developed to a size where it has outgrown the netting it will be much less likely to be damaged by the pest than when it was small, and the damage will not be serious.

One of the big advantages of starting cucumber plants under glass is that damage from the striped cucumber beetle is thereby largely avoided, as the plants are not set in the field until they are about 4 weeks old. When the seed is sown

directly in the field, it should be sown liberally in order to allow for the damage that is likely to occur from insects.

**39.** The **spotted cucumber beetle**, known in the South as the *corn-root worm*, is very nearly the same size as the striped cucumber beetle and has much the same life history. It lays its eggs near the main stem, its larvas feed on the stem and roots, and the insect winters over in the mature form. This insect does less damage to cucumbers than the striped cucumber beetle, no doubt because it is a far more general feeder—that is, it eats a much greater variety of plants—and hence it gives less attention to cucumber seedlings.

The control of this insect is the same as that for the striped cucumber beetle.

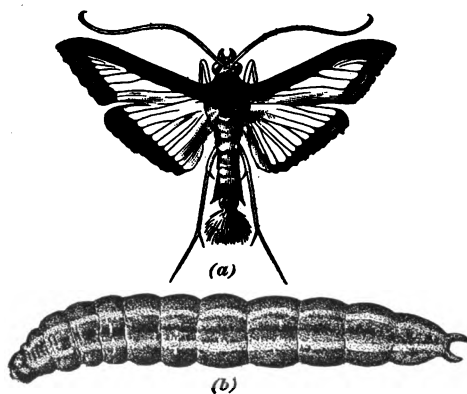


FIG. 10

**40.** The **melon aphid**, shown in Fig. 9, attacks cucumbers in June or July or later; a winged female is shown in (a), a wingless female in (b), and

a side view of a female in the position assumed in sucking juice from a leaf in (c). To prevent damage by this insect, a close watch should be kept. The presence of these insects on a plant will be betrayed by the curling of the leaves on which they are congregated. Early in the season any leaves that show a tendency to curl should be taken off and burned. If all of these early colonies are destroyed no more trouble from the aphid will be experienced during the season. This picking off of the infested leaves is less difficult than at first appears, because the first colonies are few in number and the leaves that are infested with the insects curl very noticeably.

Both tobacco dust and kerosene-oil emulsion will kill the melon aphids by contact, but they are difficult to apply where they are most needed.

41. The **melon worm** also feeds on cucumbers and squashes as well as on melons. This worm is the larva of an early white moth, shown enlarged in Fig. 10 (a), that is marked with black on the wing borders; the worm is shown enlarged in (b). The worm feeds on the leaves and can be readily destroyed by means of an arsenical poison. This pest is most prevalent in the South.

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#### FUNGOUS DISEASES

42. In many localities, cucumber growing has become a most uncertain business because of the damage to the crop by fungus diseases, the most serious of which is downy mildew.



FIG. 11

43. **Downy mildew**, or *cucumber blight*, is a disease that attacks nearly all vine crops, but it does the greatest damage to cucumbers and melons. This disease appears in July or August, commonly during or just after a spell of hot, moist weather. This disease causes the formation of yellowish spots on the leaves, first on the older foliage near the root and

later on all the leaves. These spots are bounded by veins that cause them to be angular in shape; when free to spread and when the conditions are favorable, these spots increase rapidly in area until the whole leaf is covered with them, and becomes dried and shriveled up; in 2 or 3 days a whole field of cucumbers may be destroyed. Cucumber leaves with small spots are shown in Fig. 11. A close examination of the older leaves on the vines suffering from the disease will show a fine down on the under surface. This is caused by a growth of the spore-bearing threads of the fungus, and on these threads are produced the summer spores which the wind carries from plant to plant and from field to field. The fungus winters



FIG. 12

over without difficulty, although by what means is not known, as no one has yet discovered any winter spores.

This disease may be controlled by spraying with 4-5-50 Bordeaux mixture (4 pounds copper sulphate, 5 pounds stone lime, water slaked, and 50 gallons water). In sections where the downy mildew is prevalent, the sprayings should begin as soon as the plants begin to go to vine, and further sprayings should be made at intervals of about 10 days.

**44.** The **sclerotium** disease of cucumbers sometimes appears to a sufficient extent to cause serious injury. This is a peculiar disease causing a stem rot and scars similar to but larger than those caused by anthracnose on beans. These

spots increase in size until the stem is encircled and killed. The fungus lives over winter on the dead tissue and spreads from this in the following spring. This disease also affects other vegetable crops, particularly lettuce, on which it causes the disease known as *lettuce drop*.

The control of this disease is difficult and must be mainly confined to preventive measures. All infected plants should be destroyed by burning. The use of lime on the soil is usually effective in lessening the liability of attack from this disease, and fresh manure should not be applied to the soil immediately preceding the planting of cucumbers, because such application seems to favor the spread of the disease.

**45. Cucumber wilt** is caused by bacteria that enter the plant through wounds on the leaves and stem; such wounds are often caused by insects. Once inside the plant, the bacteria seek the sap-conducting tissue of the plant, where they rapidly multiply until they clog the passages. Plants affected with this disease will usually show the first signs of wilting during the heat of the day when the expiration of moisture is most rapid, because the clogged condition of the sap passages will not permit enough moisture to be carried to the leaves. Later the affected plants show a continuous wilted condition, as illustrated in Fig. 12, and finally die of a condition that may aptly be likened to thirst or choking. Often no other external evidence of disease than the wilting will be noticed.

The sprayings that are given for the control of the downy mildew will also keep the cucumber wilt in control. The sprayings should begin by the time the plant has begun to run to vine, and they should be repeated at intervals of from 10 days to 2 weeks until the vines have stopped growing.

## HARVESTING AND MARKETING

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### HARVESTING

46. Cucumbers are harvested from the vines either by cutting or breaking the stem close to the fruit; the latter practice is the more rapid. The price of cucumbers is governed by their size. A cucumber for slicing, to be ranked in the general market as fancy, should be from 6 to 9 inches long and about 2 inches in diameter throughout nearly its entire length, and should be of a dark-green color with faint light streaks at regular intervals, extending back from the blossom end about 2 inches. To be most suitable for the general run of pickles, the cucumbers should be picked when about 2 inches in length.

47. The time for harvesting cucumbers is one of the most important factors, if not the most important single factor, in securing the best results. When the seeds are allowed to ripen in the fruit, the vitality of the vine is sapped, and the vine becomes inactive, and soon ceases to grow. On the other hand, if the cucumbers are picked before the seeds have had a chance to mature, the vine will continue to throw out new fruits in abundance in an effort to produce seed. Hence, unless the vines are systematically, frequently, and carefully picked over, much of the money expended in producing the crop will be wasted, and there will be little or no profit.

When cucumbers are planted about June 1 and the crop has been grown under favorable conditions, the vines will be ready for the first picking during the latter part of July or the first part of August. At this time there will be so few fruits on the vines that most inexperienced persons would not consider it worth while to gather them. From the point of view of the value of these first few cucumbers this would no doubt be true, but to prolong the usefulness of the plant the gathering of these first fruits is essential. In fact, the first two or three pickings will seldom pay for the wages of the pickers, but they are none the less necessary.

48. When picking has once been begun, a field should be picked over once in about 48 hours during the early part of the season, and once in 72 hours later in the season. The time between pickings should vary according to the weather—the warmer the weather, the greater the necessity for frequent pickings. Also, when the marketing is done regularly, it is advisable to pick a portion of the field each day in order to keep up a steady supply for sale.

Every effort should be made to pick off every cucumber of marketable size at each picking. This will, of course, not be possible literally, because the pickers will always overlook some of the fruits no matter how careful they may be, but unless they are constantly prompted in the matter, they will be likely to leave a number that will be excessively harmful. The pickers should also be warned about breaking and tearing the vines during picking, because this greatly reduces the total available leaf surface, shocks the plant, and thus reduces the yield. Vines that are properly handled and not injured in picking should continue to produce cucumbers until they are killed by frost in the fall.

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#### MARKETING

49. Except during a short time in the summer, cucumbers are considered as a luxury, and as too expensive for most people. Formerly, cucumbers were found in the markets only during the warmer months, but, because of the increased quantities that are now grown under glass, they have come in a limited way to be an all-year-round vegetable, and are found in varying supply in the markets every month in the year.

In the New York wholesale markets cucumbers are most commonly sold by the bushel basket. At various times, however, they are also sold by the crate, by the bushel, by the case, by the barrel, and, when the crop is exceptionally high-priced, by the dozen.

Cucumbers sell for the highest average prices during the months of March and April, although good prices are secured during all the cold-weather months. The crop raised at this time, however, is expensive to produce, as it is grown under

glass, and the net profits are not so much greater than those from the summer-grown crops as the prices would seem to indicate. After April the prices show a marked decline. Cucumbers sell for the lowest average prices in July, August, September, and October. In November, the prices show a sharp advance, and reach their highest point again the following spring.

Table I shows for each month the low and high extreme and average prices of cucumbers per bushel basket in the New York

**TABLE I**  
**PRICES OF CUCUMBERS IN THE NEW YORK MARKETS**

Month	Per Bushel Basket			
	Extreme Prices		Average Prices	
	Low	High	Low	High
January.....	\$1.00	\$4.50	\$1.50	\$3.21
February.....	1.00	4.00	1.70	3.90
March.....	1.50	4.00	2.13	3.88
April.....	1.00	4.50	2.00	3.86
May.....	.50	3.25	1.08	2.48
June.....	.25	2.75	.55	2.18
July.....	.15	2.25	.26	1.44
August.....	.15	2.00	.38	1.02
September.....	.25	2.00	.41	1.17
October.....	.25	2.00	.54	1.47
November.....	.50	4.00	1.58	2.85
December.....	1.00	3.50	1.45	2.78

wholesale markets for the 10 years from 1903 to 1912, inclusive. These prices are computed from the average of the low and high prices on the first and fifteenth of each month for the 10 years mentioned. They clearly indicate the general average trend of prices. A careful study of this table, and an accurate computation of the cost of production of a cucumber crop at different times of the year, will enable the grower to market his product to the best advantage.

In many local markets, cucumbers bring fancy prices during the winter, in fact, much higher prices than in the New York wholesale markets. Prices of 4 to 5 cents each are common for cucumbers of the first grade, and in exceptional cases 10 to 18 or 20 cents apiece, wholesale, can be obtained. Very few vegetables bring such high prices.

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## SQUASHES

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### GENERAL REMARKS

**50.** The **squash** is a native of the Levant, and, about the end of the 16th century, was first introduced into England, whence it was brought to America. Squashes are popular in many localities and are grown on market gardens, truck farms, and general farms. In the larger markets there is a strong demand for different kinds of squashes at all times of the year.

The squash is wholesome and fairly nutritious, and is commonly prepared for the table in the same manner as the turnip. The flesh must be boiled until tender to be of the best edible quality. Pies are made from some of the winter squashes.

**51. Commercial Importance.**—Although the total value of squashes produced in the United States is not as large as that of some of the other vegetable crops, squashes are an important crop on many market gardens and truck farms. According to the census, the crop produced in the United States in 1909 was valued at \$207,391, raised on 2,380 acres, distributed among 1,002 farms; this shows an average of 2.37 acres per farm. These figures include only the squashes raised in patches of 1 acre or more; considerable quantities are raised in smaller patches.

Squashes are extensively raised, being produced commercially in almost every state in the United States; the largest part of the crop is raised in the New England states. The ten principal states, ranking in the order of the crop produced, are Massachusetts, Maine, California, New York, Florida, Illinois,

Michigan, New Jersey, Ohio, and Colorado. These ten states produce about 86 per cent. of the total crop, Massachusetts produces about 44 per cent., Maine about 10 per cent., and California about 7 per cent.

The average income per acre for squashes in the United States is about \$82. The approximate average incomes per acre for the principal states are: Massachusetts, \$164; Maine, \$111; Florida, \$99; Ohio, \$93; Illinois, \$76; New York, \$64; Colorado, \$57; New Jersey, \$56; California, \$50; Michigan, \$41. These average incomes per acre are based on the census returns; many progressive growers succeed in getting much higher incomes per acre.

**52. Cost of Production per Acre.**—The cost of production for squashes naturally varies much with different growers, due partly to the methods of management and the difference in conditions under which the work must be done. The following estimate made by the late James J. H. Gregory, a prominent Massachusetts grower and seed producer, may be taken as a fair basis:

Plowing twice.....	\$ 6.00
Four cords of manure, at \$8, landed in the field.....	32.00
Distributing the manure.....	3.00
Cultivating in the manure.....	3.00
Guano, or some equivalent, to mix in hills....	5.00
Mixing guano, or other material, in the hills..	2.00
Seed.....	4.00
Planting the seed.....	1.00
Three cultivations during the season.....	5.25
Two hoeings.....	3.00
Lime and its application.....	1.50
Hand weeding of scattered weeds after runners have started.....	1.00
Gathering of crop into heaps prior to carting	2.00
Interest on land.....	9.00
Wear and tear and incidentals.....	2.00
Total.....	\$79.75

**53. Climatic Requirements.**—Squashes are all sensitive, tender to frost, and thrive to best advantage during the hot summer weather. They are, however, somewhat less liable to injury from frost than melons and cucumbers.

Because they are sensitive to cold, squashes should not be planted until the danger of frost is past and the ground is thoroughly warmed up.

**54. Soils.**—Squashes, like all of their near relatives, must make a rapid growth to mature before frost, and consequently require a rich, warm, well-drained soil and an abundance of moisture. The texture of the soil is also important; it should be loose and open so that the roots of the plants can readily find their way through it. Gravelly and sandy soils are preferred to others, and most of the squashes are grown on such soils. Probably the open texture and the usually well-drained condition of a gravelly soil is an important point in its favor. Gravelly soils that are heavily manured and fertilized will usually give less vine growth and greater yields of squashes than other soils that are equally well fertilized.

As a general rule, squashes cannot be grown to advantage in hard clay soils, or even in clay loams; few experienced growers care to attempt it. The plants do not get a foothold quickly on such soils and it is unsafe to sow the seeds early enough. The Hubbard squashes, however, will yield heavier and be of better quality when grown in a strong soil, and when properly handled some of the heavier soils may be adapted for their culture. A clay loam that is well-drained and heavily manured and fertilized may be suitable. Fresh undecayed manure is most suitable for this purpose if applied the previous year, because it will make the soil more porous than well-rotted manure.

Squashes will apparently thrive well on rich bottom lands, because they will produce an immense vine growth on such soils, but, when grown on such land, the fruits are likely to be rather porous, of a poor, coarse, water quality, and poor keepers. In some cases the plants may run to vine so much that the fruits will not be well formed. Fruits grown on

meadow land will nearly always be light in proportion to their size. Meadows that have had a considerable proportion of sand or loamy soil worked into them may be made suitable for squash culture. On low ground that is very wet and cold, the growth of the vine will be lessened, the fruit, and consequently the crop, reduced in size and weight, and in exceptionally bad cases the fruit will lose its distinctive form and become flattened at the ends instead of having the normal elongation.

Unlike most vegetables, and particularly unlike many varieties of cucumbers and melons, squashes do well on a freshly broken sod. This is an important fact to bear in mind, because not only will squash make a good crop on such land, but the freedom of sod land from many of the insect pests particularly injurious to squashes minimizes the loss from this source. Sod land that contains considerable quack, witch, or twitch, grass must be carefully handled, however, or this grass may smother out the squash vines. The sod should be deeply plowed and well covered with soil; to prevent further growth the quack grass should be buried under at least 2 inches of soil. These precautions will usually effectually keep it in check. If, however, the quack grass shows much growth through the soil before the vines begin to run, the field should be plowed up at once, because the cost of hoeing and hand pulling necessary to subdue this grass would be greater than the value of the crop. Although squashes will do well on a freshly broken sod, they should never be planted in holes cut in sod or in a patch of weeds, as is often done along the fence rows. The squash roots cannot successfully compete with the more vigorous and more numerous grass roots, and the vines cannot be expected to make a satisfactory growth in such an environment.

## VARIETIES, SEED, AND SEED PRODUCTION

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### VARIETIES

55. There are many varieties of squashes and these vary widely in appearance and quality. They may be roughly grouped in two classes as **summer squashes** and **winter squashes**; sometimes they are called *early squashes* and *late squashes*, respectively, although strictly speaking there are early and late kinds in each class. The summer squashes include several bush varieties, the fruits of which mature earlier, have a softer rind, and will not keep so well as those of the winter squashes; most persons also consider that the summer squashes are inferior to the winter squashes, although this is necessarily a matter of taste; summer squashes are sold largely during the summer months, but a part of the crop reaches the larger markets from truck farms in different sections at practically all times of the year. Summer squashes are largely grown on market gardens and truck farms.

Winter squashes include a number of varieties which grow a long, luxuriant, running vine, and which require a long season in which to mature a crop. They are extensively raised on market gardens for the market, and on some truck farms and some general farms as a crop for the canneries, and in some localities they form a staple farm crop. They are about the coarsest of the market-garden crops, and the most intensive growers do not raise them.

56. There is considerable confusion among many persons as to the classification of squashes and as to the distinction between a squash and a pumpkin. With classifications based on details of botanical structure, it is particularly difficult to straighten out the tangle. For example, the kinds usually classed by botanists as summer squashes are not squashes at all but pumpkins. Professor L. H. Bailey has the following to say in regard to this matter: "Squash is a name adapted from an American Indian word, and is applied in an indefinite

way to various plants of the genus *Cucurbita*. The application of the name does not conform to the specific lines of the plants."

The name *Cucurbita* is the classical name applied to all gourds, pumpkins, and squashes. Botanically, summer squashes of the various kinds, the common field pumpkins, and gourds are classed together as *Cucurbita pepo*. The Canada crookneck, or Cushaw, and the winter crookneck squashes are classed as *Cucurbita moschata*. And such kinds as the Hubbard, Marlbehead, Boston Marrow, Essex Hybrid, and the mammoth field squashes and pumpkins are classed as

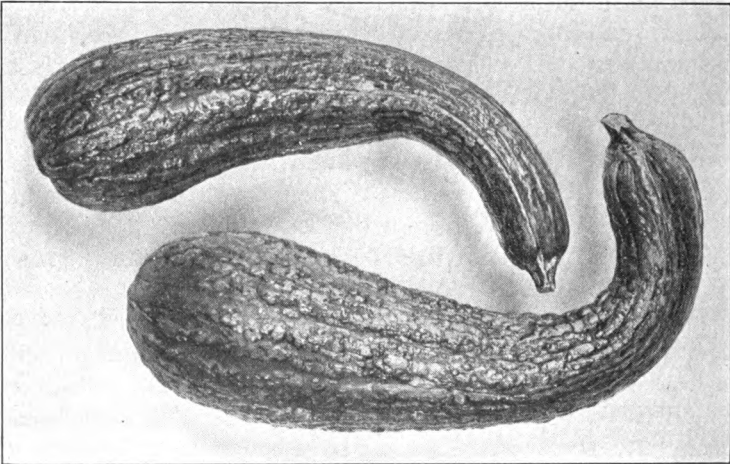


FIG. 13

*Cucurbita maxima*. If the name squash belongs to one species more than to another, this species is probably *Cucurbita maxima*.

**57. Summer Squashes.**—The principal market varieties of summer squashes are: the *Summer Crookneck*, the *Giant Summer Crookneck*, the *White Bush*, and the *Yellow Bush*.

**58.** The **Summer Crookneck** squash is a quick growing variety of the bush type that yields an abundance of small, yellow, and rather warted specimens of the typical crookneck shape. The fruit is about 6 to 10 inches long and about 4 inches in diameter at the thickest part. Although this

squash was formerly much grown, it has now been largely superseded by the Giant Summer Crookneck.

**59. The Giant Summer Crookneck** squash, illustrated in Fig. 13, is also a quick-growing variety of the bush type; when planted about May 5 in the latitude of New York City, marketable fruits can be obtained late in July. This squash is the same shape as the Summer Crookneck but is about twice the size of the latter. It is from 12 to 16 inches long and from 4 to 6 inches in diameter at its thickest part. This squash is much superior to the small summer squash and is a most popular variety. The vine grows from 24 to 36 inches high and has a spread of from 3 to 4 feet. The seed should be planted in rows 6 feet apart and the hills should be spaced about 4 feet apart in the row.

**60. The White Bush, White Scallop, or White Pattypan**, squash shown in Fig. 14, is, as its name indicates, of the bush type. The

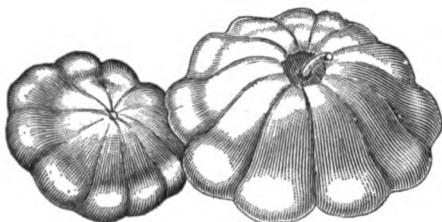


FIG. 14

squashes are white, flat, and scalloped on the edges. The variety requires about the same length of time as the Giant Summer Crookneck to produce marketable squashes from seed, and the yield is prolific. This variety is popular in some markets, but on the whole meets with a much less ready sale than the crookneck squashes.

**61. The Yellow Bush, Yellow Scallop, or Yellow Pattypan**, squash is identical with the White Bush squash except for color.

**62. Winter Squashes.**—The classification of winter squashes has been previously considered. From a market point of view, the principal varieties of winter squashes are: the *Boston Marrow*, the *Delicious*, the *Hubbard*, the *Golden Hubbard*, the *Marblehead*, and the *Essex Hybrid*.

63. The **Boston Marrow**, or *Early Boston Marrow*, squash is one of the earliest and one of the leading varieties of the winter squashes. There are a number of distinct strains of this variety, and they vary in size, shade of color, and smoothness of surface of the fruits. In most markets, the squashes with a deep, orange-red or orange-yellow rind and a warted surface are preferred. The fruit weighs from 7 to 10 pounds, the average being about 8 pounds. The flesh is salmon yellow in color and is of good quality. The Boston Marrow is considered excellent for making pies and is a most popular canning variety.

64. The **Delicious** squash has become popular in some

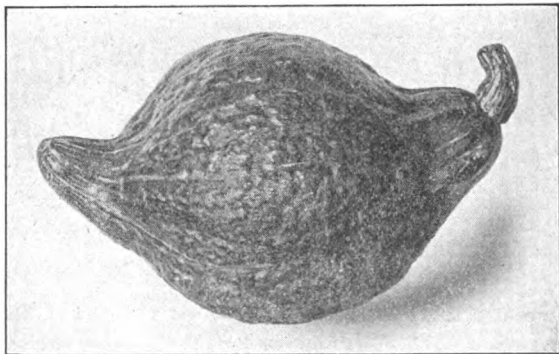


FIG. 15

markets in recent years. The outside of the squash is green, and the flesh is dark-orange colored, thick, dry, rich, and sweet. The Delicious squash is of a peculiar shape, being broad at the stem end and tapering rather regularly to a blunt point at the blossom end. The average weight of the squash is from 7 to 8 pounds. The Delicious squash is a fair keeper and is particularly valuable for the home garden.

65. The **Hubbard** squash, shown in Fig. 15, is the standard variety of winter squash, and is most in demand in all markets. There are a number of strains of this squash, the green and the golden being the most prominent. The green strain is commonly referred to simply as the Hubbard squash; the

golden strain is called the Golden Hubbard or the Yellow Hubbard, and is usually considered as a distinct variety. There are also two strains of the green Hubbard squash—the warted and the smooth; the warted strain is generally considered to be of somewhat the better quality and a better keeper, and is generally preferred in the markets. The Hubbard squash tapers toward both ends, but the taper is more abrupt at the blossom end and comes to more of a point. The squashes of a good strain of the warted type are heavily warted, and, when they are properly matured, the shell is hard; the shell of both the warted and the smooth squashes is a deep green. The flesh is thick, of an orange color, cooks dry, and has a rich flavor. The Hubbard squash varies greatly in weight. Perhaps the greater number vary from 7 or 8 to about 15 pounds in weight, although some weigh as much as 25 and 35 pounds. The retail trade prefers the smaller squash—from 7 to 10 pounds—and the hotel trade and baker's trade, which is extensive, the larger sizes—those from 25 to 35 pounds. The Hubbard squash is a splendid keeper, and, when properly stored, can be carried over until February and March in good condition.

**66.** The **Golden Hubbard**, or *Yellow Hubbard*, squash is of the same general conformation, quality, and comparative value as the green kinds of Hubbard squash. Practically the only difference is that the squashes of this variety have bright, deep orange yellow shells. A few markets prefer squashes of this color.

**67.** The **Marblehead** squash is a comparatively new variety that shows considerable promise. In shape it is somewhat like the Hubbard squash, but is longer from the stem end to the blossom end. The shell is a cabbage blue in color, is rather smooth, and somewhat furrowed. The flesh is of good quality. This squash grows to a fair size and weighs from 8 to 15 pounds.

**68.** The **Essex Hybrid** squash, shown in Fig. 16, is the most popular variety of a group of winter squashes known as

the *turbans*, so called because of the peculiar turban-like growth at the blossom end, which seems like a small squash growing out of the larger one. The Essex Hybrid is strictly a winter variety. It is cylindrical in shape, and is flat on both the stem and the blossom ends, except for the peculiar

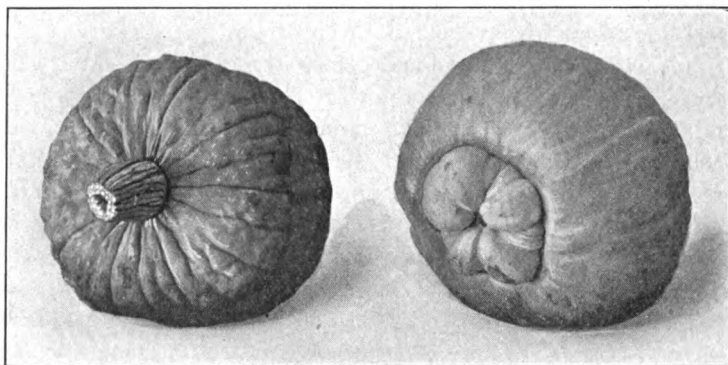


FIG. 16

turban-like growth on the blossom end. The shell is very hard, and is for the most part of a bright orange color; on part of the central growth at the blossom end it is white, however. The flesh is thick and of good quality. The squashes of this variety average about 10 pounds in weight and keep well.

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#### SEED AND SEED PRODUCTION

**69.** The home production of squash seed is perfectly feasible and is practiced by a large number of growers. In growing squashes for seed production, care should be taken not to plant near together varieties that will cross, or cross-pollination may occur. Vine crops are all alike in their nature of blossoming. Although cucumbers will not cross with melons nor squashes with cucumbers, nor even summer squashes with winter squashes, still the varieties of any one class will readily intercross. Hence, different varieties of the same class of squashes that are to be saved for seed should be planted as far apart as is convenient. When grown for seed, they should never be planted less than 500 feet apart. Hand

pollination is often practiced to insure the female blossoms being fertilized from the desired male blossoms. Unless hand pollination is practiced and the fertilized flowers afterward tied up in paper bags, planting different varieties even 500 feet apart is not satisfactory. Bees are active agents in cross-fertilization, and a strip of wood between plantings will tend to prevent cross-fertilization from this source.

The culture of squashes intended for seed production is the same as that of those intended for market, except perhaps that the seed vines should be favored as much as possible, and no check to their growth allowed. They should be kept free from all insect pests and diseases, and if any plants show a susceptibility to diseases, no seed should be saved from them.

**70. Selection.**—In selecting squashes for seed, they should be taken only from the best vines. These vines should be strong and healthy and should be productive of a large number of uniform fruits; other things being equal, the seed fruits should be selected from the vines that bear the earliest fruit.

Too much attention should not be given to the selection of the fruits to the exclusion of the proper consideration of the characteristics of the parent vines, but still a careful examination of the fruits selected is essential. Fruits should be selected for: (1) size, (2) external appearance, and (3) the quality and quantity of edible flesh on them.

1. As a general rule, the medium-sized squashes should be selected, and the extra large and the small fruits should be discarded or sold. Few growers would save the small fruits for seed, but the temptation to save the largest fruits is very strong because large fruits mean heavy yields. Especially strong is this temptation to select large fruits if the largest fruits happen to be of true form and are well-ripened; in the case of the Hubbard squashes, well ripened would mean that the shell was hard. Unfortunately, however, the extra large squashes usually have impure blood in them, and continued selection from the largest has often resulted in the serious deterioration of a strain; in selecting for the one character

of size, the other desirable characters are usually diminished. Many Hubbard squash seed growers have had the experience of seeing their squashes become soft shelled as a result of selecting only the largest fruits for seed.

2. The external appearance of the fruits should conform as nearly as possible to the true external characteristics of the variety under consideration. For instance, in a Hubbard squash the shell should be thick, hard, and of a dark-green color; the selection for color should be made early; that is, when the fruits are just reaching their full size, and the vines bearing fruit of good color marked, because later the color is not so good; squashes of very poor color at seed-taking time should be discarded. Both the neck and the calyx ends should be well formed, and in both the Hubbard and the Marrow squashes the stem should have a sharp bend in it a short distance from the fruit; a depression in the fruit around the base of the stem indicates a tendency to ripen early. At the center the fruit should swell out well; this indicates good vitality and the possibility of holding a large quantity of seed; many growers argue against such a selection because, especially in the case of the crookneck squashes, a large neck and a small seed end is generally considered to be the ideal market kind; but if squashes are selected for those with a small seed end, in a few years the strain will deteriorate and become almost worthless. The weight of a squash in proportion to its size is a fairly reliable indication of the thickness of the flesh.

3. The flesh should be hard, thick, fine grained, free from stringiness on the inside, and of good quality. No other way of testing the quality of the flesh is better than cooking and eating it. This should be done with a number of specimens, although, of course, only a small portion of the flesh of any one need be cooked. This should be done after the fruits are thoroughly ripened and when the time has come for the removal of the seed. When cooked, the flesh should be dry, fine, and of good flavor; many apparently superior squashes will fall far short of the standard when the flesh is cooked and tested in this way.

**71. Time for Removing Seed.**—Squash seed should not be removed from the fruit until it has thoroughly matured, or ripened. Seed that is removed prematurely will be about 20 per cent. lighter when dried than fully matured seed, because the inner meat, or solid matter, will be greater in the fully developed seed; the immature seed will have a lower germinating power, and the plants developed from it will not be so strong as those from mature seed. Contrary to the common belief, squash seed does not become fully ripened until from 1 to 3 months after the vines die, or after the fruit has been placed in storage. The length of time required for this ripening process after removal from the vine depends somewhat on the season in which the fruits are grown. Fruits grown in a dry season require much less time to mature their seed than those grown in a wet one.

**72.** The only way of determining with certainty when seeds are fully mature is to cut open the fruit and inspect the pulpy matter in the center, in which the seeds are imbedded. After a squash is harvested, the seeds continue to draw on this pulpy matter for nourishment, and after a certain length of time will take up practically all of it. During this time the seeds continue steadily to increase in plumpness and weight. The seeds will not be fully ripe until the different seed compartments are distinct, and the inspection of one or two fruits should serve to determine the degree of ripeness of the lot.

If, when a squash is opened, the seeds are found to be embedded in a hard, dense mass of vegetable matter that is well filled with moisture, they will not be ripe and hence will not be ready for cleaning. Seed in such pulp will also be hard to clean, and, as previously mentioned, will be light when dried. Seeds removed as soon as a squash is taken from the vine may at the time present a plump appearance, and yet after they are dried many of them will be well filled on one side only, a large percentage will be twisted, and a certain number will be practically devoid of meat. Seeds having this appearance will have a low market value.

**73. Cleaning the Seed.**—Squash seed may be cleaned either (1) without the use of water, or (2) by using water for washing either before or after fermentation of the pulp. The best looking seed can be secured when water is not used in cleaning, but, when large quantities of seed are to be handled, the extra work necessary usually makes it impracticable. After the unwashed seed has been run through a winnowing machine and has been dried it has a much more velvety appearance than the washed seed, and the drying takes less time, but otherwise the labor is greater. The larger part of all commercial seed is washed.

1. Probably the best way to remove seed from the surrounding pulp without washing is to place the pulp containing the seeds in a strong bag just as they are taken from the fruit and then to trample the pulp thoroughly until it is reduced to a soft mass. Next, the seed should be rubbed over a sieve until the greater part of the pulp is pushed through and then be rubbed between the hands to remove more of the pulp. Drying, as described later, should follow, and the seeds should again be rubbed between the hands to remove any small particles that may still adhere. The seed should then be carefully hand picked, and all specimens in any way injured or defective should be discarded. The labor required to free seed from all adhering particles of pulp is much more than at first appears.

2. The way squash seed is washed commercially in large quantities is as follows: The pulp, as soon as it is removed, is thrown on a very coarse screen placed over a tub containing clean water; pressure forces the seeds through the screen and they drop into the water, most of the pulp being left behind. Then the material in the tubs, including part of the water, is placed in a revolving churn and thoroughly agitated. After this the mass is thrown on a finer screen and as much as possible of the pulp washed from it with clean, running water. The seeds are then spread out to dry. The cost of cleaning seed by this method is much less than by the previous one.

In order to soften up the pulp and thus make it easier to remove, some growers ferment the mass of pulp containing

the seeds. This often materially reduces the labor cost, but, unless the quantity to be handled is very large, the best results can be obtained by cleaning the seed as soon as possible after it is removed from the fruit. In fermenting the pulp, considerable experience is necessary to avoid damaging the appearance of the seed. If the fermentation is carried too far, the white, ivory-like covering of the seeds will be lost, the attractive appearance impaired, the market value lessened, and, if the fermentation is carried far enough, the germinating power of the seed will be injured.

Usually, the fermentation should not continue more than 1 or 2 days, and the temperature should never be allowed to mount too high. The pulp should be placed in cold water, and on the second day the temperature of the mass should be tested by thrusting the hand into it. If it seems to be about as warm as freshly drawn milk, the fermentation has proceeded as far as is safe, and the seed should be washed within a very few hours. The fermenting mass should be thrown on sieves fine enough to prevent the seed from passing through and washed with a steady stream of water. Some persons prefer to use water warmed to about the temperature of the fermenting mass, because warm water has a greater solvent action than cold water, but warm water is seldom available to the small seed grower in large enough quantities and is not essential. The screens should be inclined at an angle first from one end then from the other, so that the water will wash the seed and pulp over the wire. If the pulp has been well fermented, it should readily wash away from the seed and through the screen. As soon as the seeds have been drained, they should be placed on dry cloth, rubbed well to remove the greater part of the moisture, and then dried.

**74. Drying the Seed.**—The drying of squash seed calls for considerable attention to details or the market value of the seed will be greatly impaired. Seeds that have been squeezed out—that is, those that have been cleaned without the use of water—can be dried on almost any surface, because the small particles of pulp that adhere will prevent them from

becoming soiled, as any dirt that sticks to these particles of pulp is removed later when the seeds are rubbed. Washed seed, however, whether washed before or after fermentation, must be dried on a very clean surface or they will not appear bright and clean.

The seeds should be spread out thinly on the drying surface, preferably not more than one deep, although unwashed seeds may be spread somewhat thicker without injury. The seeds should be allowed to remain as laid down until the second day, when they should be stirred. Washed seeds particularly will stick tightly to the drying surface for the first couple of days and if they are stirred too soon the outer skin will be marred.

Squash seeds should be dried in a temperature not exceeding 100° F., and preferably the temperature should be somewhat lower. When dried at too high a temperature the germinating power of seed is injured. Hence, drying of seed in an oven or over a stove is not to be recommended. Neither should the seed be dried in a place where mice are likely to gnaw it.

**75.** The length of time required for drying squash seed varies with the temperature and moisture conditions and the state of the seed. No time limit can be set for drying. The only satisfactory way of determining when the seed is sufficiently dried is to attempt to bend it. If the seed is brittle and snaps on being bent it is well-dried and ready for storing; if the seed is leathery and does not snap, the drying process should be continued further. It is common to consider squash seed sufficiently dried when it looks contracted and dry and when the outer skin has separated from it; these indications, however, are unsatisfactory. Seed that is dried for a short time in a hot, dry atmosphere will appear dry externally and when shaken together will rustle, but such seed may sweat and decay quickly when stored in tight packages, because much of the original moisture still remains in its interior.

**76. Characteristics of Seed.**—Because of the similarity of culture and the similarity of the plants, squash and pumpkin seed are considered together. All of these seeds are

comparatively large. The bush scalloped squash seed runs about 500 to the ounce, and 1 quart weighs about 15 to 16½ ounces. The Crookneck squash seed runs about 400 to the ounce, and 1 quart weighs about 17½ ounces; a sample of Golden Summer Crookneck squash seed is shown natural size in Fig. 17. Hubbard squash seed is much larger; about 100 seeds weigh 1 ounce, and 1 quart weighs about 14 ounces. Pumpkin seeds are about the same size as Hubbard squash seeds, but somewhat lighter, 1 quart weighing between 9 and 10 ounces.

When kept under proper conditions, squash seed is long lived. The average period of satisfactory germination is considered to be about 6 years, and the extreme limit is more than 10 years. Although this is true of squash seed kept under almost ideal conditions, the longevity of the seed is much affected by the temperature and moisture conditions; hence, it may sometimes be worthless at 3 years of age, and all seeds more than 2 years old should be tested for percentage of germination before they are planted. The method of making such a test has been previously described in *Essentials of Vegetable Growing*.



FIG. 17

To be considered fit for planting, squash seed should be about 99 per cent. pure and about 96 per cent. of the seed should germinate.

After it is once well dried, squash seed should be kept in a cool, dry place, and in an even temperature. Preferably it should be kept in closed packages, as in paper bags.

In addition to a germination test, it is also well to inspect the seed carefully. Little can be told from the outside appearance unless the seed is obviously diseased and moldy. If the outside appearance indicates that the seeds are good, some of them should be broken open. If the inside meat is dark and has a rancid taste the germinating power of the seed is ruined; this condition is due to the oil in the seed becoming rancid

from a number of causes; usually seed with dark meat will also have a dark shell. This test is not an absolutely accurate one, however, because some seed that is apparently sound to the eye and that does not have a rancid taste will not germinate well; the reasons for this are not always clear. Hence, a germination test may be considered to be essential.

77. Pumpkin seed is less long lived than squash seed. The average period of satisfactory germination of pumpkin seed is about 4 years, and the extreme limit is about 9 years. Pumpkin seeds over 2 years of age should, like squash seeds, be tested for percentage of germination before they are planted.



FIG. 18

To be considered high grade, the seed should likewise be 99 per cent. pure, and about 96 per cent. of the seed should germinate.

78. Under favorable conditions, squash seed should germinate in from 4 to 10 days. A few squash seedlings are shown natural size in Fig. 18. Pumpkin seed is somewhat slower to germinate, the process requiring from 4 to 20 days.

79. At the usual distances of planting, from 5 to 6 pounds of seed are required for sowing 1 acre of bush squashes in hills, and about 1 ounce of seed is required to sow about 100 feet of row. From 3 to 4 pounds of seed are required to plant

1 acre of running squashes in hills, and about 1 ounce or a little less is required to plant 100 feet of row. At the common distances of planting about 4 pounds of pumpkin seed will be needed for sowing 1 acre, and about 1 ounce for 100 feet of row.

The price of the best squash seed ranges from \$1 to \$1.50 a pound in pound lots. The price of the best pumpkin seed ranges from 45 and 50 cents to \$1 a pound and sometimes as high as \$1.50 for special strains.

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### PLANTING AND CULTURE OF SUMMER SQUASHES

80. Earliness is a very important factor in determining the profits that can be secured from summer squash, and culture and fertilization should all be conducted with that end in view. The different varieties of summer squash have been developed especially for the purpose of producing an early, quick-growing, good-sized squash. The early-bearing habit of the squash is stimulated by an abundant humus and plant-food supply in the soil; also, a soil that is rather sandy and well aerated will aid in this direction. Market gardeners generally consider that well-rotted manure will furnish the best plant-food for summer squash. A southern exposure is particularly valuable for summer squash. Only by securing the best combination of all factors, however, can the most profitable returns be secured.

As summer squash in the latitude of New York City cannot be safely planted until the first or second week in May, a crop of fall-sown spinach, or a crop of spring-sown radishes, or possibly even a crop of spring-sown spinach, may be taken from the land before the squashes need all the space. If a spring-sown crop of spinach is attempted, it must be planted so that plenty of space will be left between the rows for the planting of the squash seed. If a fall-sown crop of spinach is grown, it should be removed before squash-planting time, and the land should immediately have a liberal dressing of well-rotted stable manure, say from 30 to 40 tons to the acre,

if that much is available. In the Middle West, squash is planted in the latter part of May, and in the latitude of Georgia from the latter part of February to the middle of March.

**81.** The preparation of the soil for summer squash depends to a certain extent on the method of cropping followed. If a fall-sown crop of spinach is allowed to remain on the ground all winter, the soil always should be plowed in the fall after being coated with manure and be well harrowed before the spinach is planted. If the soil is light enough, no further preparation may be necessary in the spring after the spinach is harvested. If the land is level and no winter crop is to be kept on it, time may be saved in the spring work by applying manure and plowing in the fall in the way just described; this, however, would not be advisable on ground that would be likely to wash.

The method of applying manure to land intended for squash is worthy of considerable attention. However the cropping is arranged, it will almost always pay to spade a certain quantity of manure into each of the hills where the seeds are to be planted. If only a limited quantity of manure is available, the best results can be obtained by spading some in each hill rather than by broadcasting it, although, of course, both applications are advisable.

In addition to the manure, some commercial fertilizer is also needed to balance the plant-food in the manure. A fertilizer for squash should contain a low percentage of nitrogen and a high percentage of phosphoric acid and potash; nitrogen stimulates the vine growth, but when this fertilizer ingredient is present to excess the fruit is slow to set and the crop is late. For this reason, from 500 to 800 pounds of a fertilizer analyzing 2 per cent. of nitrogen, 8 per cent. of phosphoric acid, and 8 per cent. of potash will be a suitable application.

**82.** The planting of squash seed can be best done with a hoe. The hills should be raised a few inches above the surface of the ground, and they should be free from lumps of soil or of manure. The squash seed should be planted about 1 inch deep. A small ridge may be made on the north side of the spot where

the seed have been planted to protect the young seedlings from the north wind when they first come up. When the seeds are planted early, baskets or boxes should be provided for covering the hills on cold nights. If such precautions are taken, squash seed can be safely planted from 7 to 10 days earlier than by the ordinary methods.

The hills should be spaced either  $3\frac{1}{2}$  feet by 4 feet (about 3,111 hills per acre), or 4 feet by 4 feet (about 2,722 hills per acre), the spacing being regulated by the natural vigor of growth of the vines and the strength of the soil.

From ten to fifteen seeds should be planted in each hill and should be spread over an area about 8 inches square; the seed should be covered with about 1 inch of soil, as previously mentioned; the soil above the seeds should then be firmed, either with the hoe or with the feet, and finally a light covering of loose earth should be scattered over the firmed soil to lessen the loss of capillary moisture.

**83.** Under favorable conditions, squash seed will germinate in from 4 to 10 days, although, if the soil is warm and not too moist, the average will probably be from 6 to 8 days; if the soil is cold and wet, twice as long may be required for the seed to germinate, and sometimes the seed will rot. As soon as the seedlings appear above ground, they should be covered with lime dust and Paris green or with tobacco dust, in order to save them from the ravages of the cucumber beetles. For the first month, they should be redusted often enough to keep the new growth covered. Thorough spraying with arsenate of lead, 3 pounds to 50 gallons of water, is also effective.

When the seedlings have developed their second pair of true leaves, they should be thinned to two or three of the best plants in a hill, preferably to two.

In addition to the details just described, frequent and thorough cultivation will be the only work required until harvesting time. Cultivation is essential for the best success with squashes. It should be deep and frequent enough to maintain a good dust mulch and to keep down all weeds. One or two hand hoeings are also frequently necessary.

The first summer squashes should be ready for harvesting from 60 to 75 days after the seeds are planted.

**84. Starting Squashes Under Glass.**—Summer squash seedlings are sometimes started under glass in pots or berry



FIG. 19

baskets or on pieces of sod in order to save time and produce an earlier crop. They are started early enough so that they will be 3 or 4 inches tall, or of good size for field setting, by the time squash seed is commonly sown in the open, or possibly a little later. In the latitude of New York, squash seedlings are commonly transplanted in the open

about May 15. Squash seedlings at the proper age for setting in the field are shown in Fig. 19.

To secure good results, the squash seed should be sown under glass about 2 to 3 weeks before time for field setting. It is essential to grow them in pots, etc., because the growth of the plants will be seriously checked if the soil about the roots is much disturbed while they are being shifted to the field.

#### PLANTING AND CULTURE OF WINTER SQUASHES

**85.** Although winter squashes will grow on a great variety of soils, they will usually do best on a rich, medium to light loam soil. The late-maturing varieties will yield better on a light, dry soil, because they start into growth earlier and require all the time available for their proper development.

Winter squashes are often grown as an incidental companion crop with field corn, in which case they receive little attention after being planted. On market gardens and truck farms

it is usual to intercrop winter squashes. Early sweet corn makes a splendid companion crop for winter squashes. Squashes may also be grown to advantage in many orchards.

The heavy manuring and fertilization suggested for summer squashes will give the best results with winter squashes, and will always pay when the crop is grown as a specialty and intended for storage.

Winter squashes are commonly planted at about the same time as summer squashes, although there is little necessity for getting them into the ground so early. In the latitude of New York, May 15 is considered early enough, and in other places the time of planting will be in proportion to the latitude.

The distances for planting late squashes depend somewhat on the soil, the variety, and the care to be given to them. The closest they should be planted is 6 feet by 6 feet (about 1,210 hills per acre), and the most common spacing is 8 feet by 8 feet (about 680 hills per acre); occasionally they are planted 10 feet by 10 feet (about 435 hills per acre).

About the same number of winter squash seeds as of summer squash seeds should be sown in a hill, and likewise they will need dusting with a good insecticide powder as soon as they appear above ground and two or three times thereafter before they are past danger from insect injury. The plants should be thinned to two or three in a hill when the second pair of true leaves appear.

Thorough and frequent horse cultivation should be practiced from the time the seed is sown until the vines spread so much that they interfere with the work.

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## INSECT PESTS AND INJURIES

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### INSECT PESTS

86. The insect pests which injure cucumbers and melons also attack squashes. Their depredations on squashes are somewhat less serious than on the smaller vine crops, but, at times, they do serious injury to the young squash seedlings shortly after they appear above ground if proper precautions

are not taken. The principal insects attacking the squash are the *common squash bug* and the *squash-vine borer*.

**87.** The **common squash bug**, known also as the *stink bug* from its disagreeable odor and as the *black squash bug*, is shown at work on a young plant in Fig. 20; a full-grown female is shown at *a*. This bug injures the plant in two ways: By extracting the juice from the plant, thus weakening it; and by injecting into the puncture a liquid, supposedly its saliva,

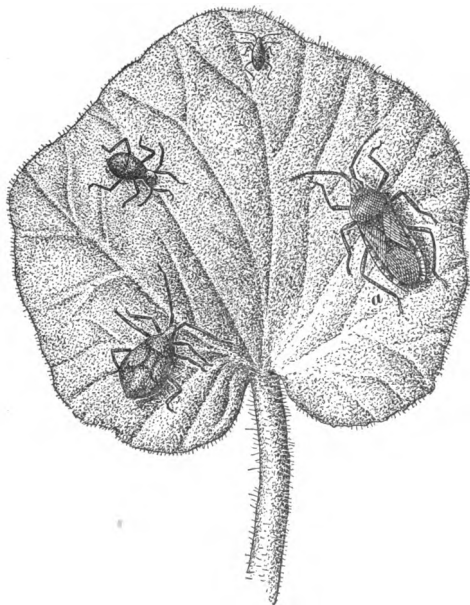


FIG. 20

which has a poisonous effect on the plant and causes the death of the tissue about the puncture. It attacks the leaves and occasionally the fruit. It is also harmful because it transmits fungous diseases from one plant to another.

**88.** The **squash-vine borer** is a serious pest of the squash in many localities. The larvae do the principal damage; they bore in the stems, inflicting the most injury at the base of

the vine. The affected parts rot, sometimes the stem breaks off, and the plants wilt and die in a short while.

The adult insect is a clear-winged moth with a wing expanse of about  $1\frac{1}{4}$  inches. The larva is a small white worm-like creature. This pest is most prevalent throughout the States east of the Rocky Mountains and southward into Central and South America.

As the larvae work in the interior of the stems, insecticides are useless. If a crop has been infested with the insect, all

vines should be gathered up and burned as soon as the crop is harvested. The ground should then be harrowed lightly several times in the fall, as this will bring the larvas and pupas in the soil near the surface; then the following spring the ground should be deeply plowed so that the insects in the soil will be so deeply buried that they cannot reach the surface. Rotation should be carefully practiced where the pest is prevalent. About the only way to kill the larvas in the vine is to slit the vine lengthwise with a knife. This can be done without seriously injuring the plant; after the stem is slit, the wound will heal quickly if covered with moist earth. It is not practical to slit the vines commercially.

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### FUNGOUS DISEASES

89. Squashes suffer less from fungous diseases than do the other vine crops, and few practical growers make any attempt to spray with any fungicide.

90. At times **downy mildew**, or *cucumber blight*, attacks and kills squashes, but much less frequently than it attacks other vine crops. The damage done is also usually much less. In fact, spraying with Bordeaux mixture to prevent this disease is seldom considered worth while. Most growers find that if they fertilize heavily the damage done by cucumber blight is very slight.

91. **Cucumber wilt** also does damage on squashes, but the damage varies with the prevalence of insect pests. Where the insects have not been properly disposed of, the cucumber wilt bacteria often do much damage.

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### HARVESTING, STORAGE, AND MARKETING

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#### HARVESTING

92. The time for harvesting both summer and winter squashes depends on the variety and on the season. Ordinarily, some summer squashes on the vines should be ready for harvesting in 60 days after the seeds are planted, and if they are cut promptly before the seeds have time to develop

much, the production of marketable squashes should continue until insects or disease kills the vines or until they are destroyed by frost in the fall. A single hill will thus yield from 1 to 2 dozen squashes.

Summer squashes are always marketed before the shell, or rind, has thoroughly hardened. For local markets, the shell need be hardened but little, but for long-distance shipments the fruit must be hardened enough so that the shells will be fairly hard. The only labor commonly necessary is to cut and pack them. Occasionally they will require washing.

The date for harvesting winter squashes depends also on the variety and on the market for which they are intended. All of the so-called winter squashes are not for winter use, but some varieties are fit for market in the early fall. The early varieties are usually sold directly from the field, and all varieties should be removed from the field before there is danger of damage from frost.

In the larger winter squashes the stage of ripening is indicated by the leaves, by the condition of the stems, and by the appearance of the fruits themselves. When they ripen naturally, that is, without being diseased, the leaves gradually turn yellow and dry up, beginning with those nearest the hill, which are the oldest. The premature dying of the leaves due to disease will be discussed later.

In the soft, thick-stemmed varieties, like the Hubbard, Marrow, and turban squashes, the approach of ripeness is indicated by the drying up of the stem. The stem will first shrink just at the point where it joins the squash and will form a small depression there; shortly after the stem itself will appear dead and dry.

The approach of ripeness is indicated in the squash by the change in color and the increase in hardness of the shell or skin. The shell of the Hubbard squash will turn to a duller, more russet color as it ripens, and the skin of the Marrow and turban squashes will turn to a deeper orange. The increase in the hardness of the shell in a Hubbard squash can first be detected on the part nearest the stem, and the shell will usually form more rapidly on the part nearest the ground than on

the upper part. When the shell on this lower part is fairly hard, the squash can be safely cut for storage. The increasing toughness of the skin of the Marrow and turban squashes can be tested by denting it with the thumbnail; as the fruit begins to ripen the increase in toughness is very noticeable.

**93.** In any case when the leaves seem to indicate premature ripeness, they should be carefully examined. Near the end of the season squash leaves are often affected by a blight, which usually first attacks the leaves on the vine nearest the hill; these turn black and die down. The inexperienced grower will often think that this is a natural indication of maturity, but the experienced one will know that when the leaves die naturally they always turn yellow. When the vines are not blighted exposure to the sun for a few days assists in the ripening process, as discussed later. But, when the squashes are exposed to the sun before the normal time, many of them, particularly the hard-shelled varieties, are very likely to be more or less sun scalded. The parts that become sun scalded may be identified by a whitening of the part that is most exposed to the sun. Squashes that are sun scalded will seldom form good shells, and when a squash is badly sun scalded the parts so injured will rot. All squashes that are injured in this way should be sold as soon as possible; they should never be stored.

**94. Cutting.**—A large, sharp knife, like a butcher knife, is probably most convenient for cutting squashes. There are two ways of cutting. (1) The most common way is to cut the stem from the vine so that only a short piece remains. This method is considered best when the squash is to be stored. The stem is hollow and for some time after it is cut a considerable amount of sap will run out of it. Particular care should be taken not to *start* the stem in cutting it—that is, to loosen it by breaking the tissue of the fruit around its base. (2) When the squash is to be marketed a few days after it is cut, the cutting is done so that all of the stem proper and a small piece of the vine remain. On some of the larger squashes, the thick, fresh stems full of sap weigh from 3 to 4 ounces,

and on a large number this will add considerably to the weight when the fruits are sold by the 100 pounds or by the ton. A few growers also prefer to cut long stems on squashes intended for storage.

**95. Curing.**—The first few days after squashes are cut from the vines is a critical period. A certain degree of experience is necessary to handle them properly, and much of the success in storage depends on how this is done. If the weather is bright and clear, the squashes should be exposed to the rays of the sun for 2 or 3 days after being cut. This will tend to hasten ripening and will dry up the cut stems; both of these improve their keeping qualities. After being cut, squashes should be moved out from under the leaves, turned over so that they lie with the part that grew on the ground exposed to the sun, and then all of the moist soil should be rubbed off of this surface with the hand.

Squashes will not stand as much frost after they are cut as when they are on the vine. If frost threatens, they should be placed in piles of fifteen or twenty each, and the vines should be pulled and laid over them. They should not, however, be allowed to remain in the piles for any length of time, because of the danger of being bruised. Immediately after the danger from frost is past, they should be spread out on the ground again so that the sun and air can get at them.

If cold rains threaten after squashes are cut, they should not be allowed to remain in the field unless they are to be sold almost immediately; in such a case, however, it will be better not to cut them until the time they are to be taken to market. Squashes that are exposed to cold rains for several days have a tendency to rot in storage.

**96. Prevention of Bruising.**—When moved about in the field and while being taken to storage, squashes should always be handled with the greatest care. They should always be laid down, and should never be dropped. The wagons in which they are hauled should be provided with springs, and some growers also pad the wagon bed with burlap, straw,

etc. Squashes that are to be stored for several months will not keep well if they are bruised. A squash may not show a slight bruise immediately, but after several weeks in storage the bruise will be very noticeable.

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#### STORAGE

97. Success in the storage of squashes depends on the exercise of the proper care in harvesting and handling and in the maintenance of the proper temperature and moisture conditions in the storage house; the air in the storage house should be kept dry and fairly cool. No bruised or cracked squashes should be stored, because they will quickly rot. It is practically impossible to ship squashes by rail and not bruise them to a certain extent, and hence it is impractical to transport squashes long distances and store them; the best place for storage is on the farm on which they are grown. The cut end of the stems on all squashes should be allowed to dry up so as to seal them before they are put in storage.

Squashes should not be too well matured when they are placed in storage or they will not keep well. In the latitude of New York City, squashes that were planted about June 1 will keep better in storage than those planted earlier.

98. Squashes can be stored either in cellars or in storage houses. The success in cellars is somewhat variable and depends largely on the dryness of the cellar; unless the cellar is particularly dry, the squash will rot quickly. Cellar storage has some advantages over house storage, because in a cellar squashes usually lose less in weight and retain their quality and their original color better. The disadvantages of cellar storage are that the squashes do not keep as long as in houses, and that they perish more quickly when sent to market; because of this latter fact, many dealers refuse to buy squashes that have been stored in a cellar, especially late in the winter.

Growers who make a business of storing squashes, almost invariably have houses built especially for the purpose. An average-sized house for this purpose will usually measure 24 feet wide, 35 feet long, and about 10 feet high to the eave

plates, and will be covered with a gable roof. In such a house from 50 to 60 tons of squashes may be stored. A low, broad building is always preferable, because in such a building the heat will be more evenly distributed; in a high building the heat is likely to be excessive in the upper part. A low building is also less exposed to cold winds, and as more of it is accessible from the floor, there will be less lifting of the heavy squashes and less likelihood of bruising them.

The storage house recommended for sweet potatoes may be adapted for the storage of squashes by placing shelves in the bins. Squashes should not be stored more than two deep, for in deeper layers those below will be bruised. Squashes and sweet potatoes are sometimes stored in the same house at the same time.

Squashes can be stored in such a house until January 1 at a cost of from \$3 to \$5 per ton. These figures include the interest on the investment, cost of heating, labor, and a loss of 20 per cent. in the weight of the crop.

The work of taking the squash into the house and of handling it for the first few weeks afterwards requires careful attention to detail. Preferably, the squash should be taken indoors on a cool, dry day; it is especially important that no moisture be present on the shells, and the squashes should always be taken in when dry or before the dew begins to form. Probably the best way to get the squashes from the wagon to the shelves is to form a line of workers and toss the squashes from one to the other. The squashes will usually be bruised less in this way, and also time is economized. After a little practice, few squashes will be dropped during this work, but any that are should not be stored. In placing the squashes on the shelves, the larger ones should be placed in the bottom layer and slanted all in the same direction; when packed in this way, the smaller squashes will not weigh heavily on those underneath, and the packing can be done to better advantage.

In spite of all that can be done, a certain quantity of moisture will be present on the squashes when they are taken into the house, and for the first few weeks special care should be taken to see that this does not cause serious molding. For

the first few days all windows and doors should be left open during fair, dry weather (this means when the air is dry), and a fire should be kept going; a fire is especially important on damp days. This treatment should cause the cut stems to dry out and heal over well; if they do not, the squash will not keep well. The stems will nearly always mold somewhat before they are well dried; if they become badly decayed there will be a rank odor in the house, and the entire lot of squashes may spoil. The stems should dry in about 3 weeks.

**99. Temperature and Humidity.**—The matter of temperature regulation is closely associated with humidity, and the two will be considered together. As warm air will take up more moisture than cold air, the squashes in a warm room are necessarily drier than those in a cold one, and there will be less danger of the moisture depositing on them. The temperature and humidity in the storage house must be regulated by means of a stove and by proper ventilation.

The best temperature at which to keep squashes is about 50° F. No harm may be done if the temperature occasionally falls as low as 40° F., or if it occasionally goes as high as 70° F., but the squash should never be frozen nor allowed to remain in a temperature as high as 70° F. for any length of time. A steady temperature produces the best results. Too high a temperature should be guarded against, especially if the squashes are to be kept until spring. The reason for this is that heat hastens ripening, and in the natural course of events decay commences soon after a squash is thoroughly ripe. When kept too hot, squashes lose too much weight and deteriorate in quality; also, green Hubbard squashes lose their attractive, dark-green color and assume a rusty, reddish color. Other things being equal, however, the Hubbard squash will keep in good condition for the longest time, and will lose less in weight than others. Under the best conditions, squashes will lose about 20 per cent. in weight in storage by January 1, and from 30 to 40 per cent. by March 1.

On account of the large bulk of squashes in a storage house, and the comparatively small quantity of air, a small stove

will supply enough heat to maintain the necessary temperature in a well-constructed building even in very cold weather. From 50 to 75 pounds of coal should be sufficient to heat for 24 hours a house of the size of the one previously mentioned.

The air should be kept as dry as possible. No careful experiments have ever been conducted to determine the exact degree of humidity that should be maintained, but the common custom is to keep the air in the house so dry that there will be no perceptible dampness in it. An excess of moisture in or about squashes makes their successful storage doubtful. Squashes raised in a wet season contain an abundance of moisture and will therefore rot more readily than those raised in a dry season; likewise, squashes will rot more readily in a cellar where the air is likely to be damp at times than in a house. The windows and doors should never be opened for ventilation unless the air outside is dry. This is a rather uncommon thing in the winter. On warm winter days, the air is usually loaded with moisture. Hence, cold days are usually best for ventilation. Cold air holds comparatively little moisture, and when it is brought into a house and warmed up to 40° or 50° F. it will take up considerable moisture from the house. The air taken in should always be colder than the air inside. A very satisfactory way to ventilate is to start up the fire and then open ventilators in the roof and near the floor. The cold air will then flow in at the bottom.

**100. Picking Over.**—It was formerly the common practice about January 1 to pick over the squashes that were placed in storage about October 1 and to dispose of all those that showed signs of rot. At the present time most growers consider that it is more profitable to allow a few to rot than to attempt to cull out the rotten ones in midwinter, because this handling necessitates a certain amount of bruising, and squashes often rot very rapidly after they are picked over. It is usually best to move squashes as little as possible after placing them in storage.

**101. Determination of Soundness.**—In judging of the soundness of a squash that has been stored, due regard must be given both to its external appearance and to its weight.

The Hubbard squash, the one most extensively stored, is particularly deceptive, because specimens will often be entirely rotten on the inside, and yet, to the inexperienced eye, appear to be perfectly sound. The first place to look for decay in a Hubbard squash is at the ends. If the shell on these parts is of a good green and unmarked by moldy spots, the squash is probably sound. Likewise, if there are only a few moldy spots on the shell, the parts underneath will probably be sound. If, however, the moldy spots are greenish or yellowish, a soft, rotten spot will usually be found immediately beneath them. If at either end the surface of the shell has a soft, watery appearance, the inside of the squash is usually badly decayed.

The weight of a squash is also an important and quick means of determination of soundness. If a Hubbard squash is noticeably light, considerable dry rot will usually be found inside of it. If a squash is much heavier than the average, it will often be water soaked and worthless. On close examination a water-soaked squash will usually be found to have a small hole or crack in it somewhere, through which air and water have been able to enter.

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#### MARKETING

102. The market demand for both summer and winter squashes is active. The market gardener usually finds that the summer squash is better suited to his business than the winter squash. The market for squashes is extensive, but the production is also, and the large quantities that are often dumped on the market cause the prices to vary considerably.

Squashes are not perishable, in the sense that they must be sold at once on receipt in the market, and hence the prices in the large markets do not fluctuate as much from month to month as those for many other vegetables.

Both summer and winter squashes are found in the New York markets every month in the year. Summer squashes are sold from November to May largely by the  $\frac{1}{2}$ -barrel basket, box, or crate, and from June to December by the barrel; the  $\frac{1}{2}$ -barrel basket will hold about 3 dozen summer squashes.

Winter squashes are sold largely by the barrel in these markets at all times of the year. The barrel is not a uniform package and does not always contain the same quantity. It is supposed to hold from 85 to 110 pounds of squashes, according to the variety, and the size and quality of the specimens.

**103.** The highest extreme and high average prices for summer squashes are received during the months of February, March, and April, although the prices in May are also good.

**TABLE II**  
**PRICES OF SUMMER SQUASHES IN THE NEW YORK MARKETS**

Month	Per ¼-Barrel Basket, Box, or Crate				Per Barrel			
	Extreme Prices		Average Prices		Extreme Prices		Average Prices	
	Low	High	Low	High	Low	High	Low	High
January.....	\$1.00	\$2.50	\$1.19	\$1.53				
February.....	1.00	3.50	1.28	2.14				
March.....	1.00	3.00	1.30	2.40				
April.....	1.00	3.00	1.05	2.30				
May.....	.50	3.00	.95	1.93				
June.....					\$ .50	\$3.50	\$ .80	\$2.25
July.....					.25	2.50	.48	1.65
August.....					.25	2.50	.48	1.28
September.....					.25	2.50	.45	1.08
October.....					.25	1.50	.50	.93
November.....	.50	2.50	1.06	1.66	.25	1.50	.50	1.13
December.....	1.00	2.50	1.25	1.50	*.75	1.25		

\*Quoted only once in this month during the 10-year period.

The prices then decline until October, when they begin to rise and continue on the upward trend until after the middle of the winter. The highest prices for winter squashes are secured during the months of March, April, May, and June. The prices then show a decline until October, when the low point is reached, and then show an increase during the other fall and the winter months. The most profit can be secured from squashes only by marketing them at the time when they bring the highest prices. It is seldom profitable to market squashes during the

months when large quantities have to be sold for as little as 25 cents to \$1 a barrel.

**104.** In Table II are shown for each month the extreme low and high prices and the average low and high prices per half-barrel basket, box, or crate and per barrel for summer squashes in the New York wholesale markets for the 10 years from 1903 to 1912, inclusive. These prices are figured from

**TABLE III**  
**PRICES OF WINTER SQUASHES IN THE NEW YORK MARKETS**

Month	Per Barrel			
	Extreme Prices		Average Prices	
	Low	High	Low	High
January.....	\$ .50	\$2.50	\$ .83	\$1.70
February.....	.75	2.50	1.20	1.80
March.....	1.00	3.00	1.33	2.17
April.....	1.00	3.00	1.44	2.06
May.....	.75	2.50	1.37	2.00
June.....	1.00	3.00	1.28	2.22
July.....	.25	2.50	.73	1.63
August.....	.50	1.50	.65	1.10
September.....	.40	1.50	.62	1.10
October.....	.40	1.25	.55	1.08
November.....	.40	2.00	.57	1.15
December.....	.50	2.00	.67	1.21

the average low and high prices on the first and fifteenth of each month for the decade in question. The prices in the New York markets are considered particularly, because these markets are the largest in the country, and the prices there may be considered fairly representative. Table III gives similar information regarding winter squashes by the barrel.

**105.** In various local markets squashes are sold by the dozen, by the 100 pounds, and by the ton. Very early summer

squashes sometimes bring as high as \$1 a dozen. A little later the price drops to about 25 cents a dozen, and many market gardeners consider that an average price of about 35 cents a dozen is profitable.

In the local markets along the Atlantic seaboard the demand for summer squashes frequently becomes rather limited by the middle of August, although much, of course, depends on the market and on the season. If the general supply is so abundant that they must be sold for less than 25 cents a dozen, many market gardeners deem it advisable to plow under the vines and plant a fall crop in their stead—usually spinach.

106. In some local markets the more common way of selling squash is by the 100 pounds or by the ton. In such markets early squashes sell for \$1 to \$3 a 100 pounds. Late in the season the tendency is to sell squash by the ton, and the prices may go as low as \$10 a ton, or at the rate of 50 cents a 100 pounds. Well on in the winter, however, the prices may mount to \$50 or even as high as \$100 a ton. In mid-winter, a good average price for squash in local markets is from \$35 to \$40 a ton, and at these prices it is a profitable crop.

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## PUMPKINS

107. The **pumpkin** is a close relative of the squash, as previously mentioned, and is a native of India and the Levant. A large portion of the pumpkins grown are produced on general farms for stock feed. Some of the smaller and better kinds, however, are grown to a limited extent on market gardens situated where there is a demand for pumpkins. Because of the limited demand and also on account of their large bulk and weight and low market price, pumpkins are of little importance as a truck crop.

In the United States the principal domestic use for pumpkins is for pie making, and they are most popular for this purpose in the New England States. They are also used in this country and in Europe to a limited extent for soups and stews. If kept in a cool, dry place that is free from frost, pumpkins can be

kept for food well into the winter. They can also be preserved for winter use by boiling and drying the pulp in an oven, or by cutting the flesh in strips and drying it before a fire.

**108.** Pumpkins require about the same climatic conditions, and about the same soils as do squashes. They do not require as rich soils as do cucumbers or melons, but they do well on almost any fairly fertile land. They do particularly well on newly cleared land.

**109.** There are about a dozen varieties of pumpkins listed by the various seed houses.

**110.** The **Small Sugar** pumpkin, shown in Fig. 21, is the best variety for most market gardeners. This pumpkin averages about 10 inches in diameter, is flattened and slightly ribbed, and has a bright-yellow rind. The flesh is very sweet. These pumpkins are of a good size to sell to a retail trade.



FIG. 21

**111.** The **Large Field** pumpkin, shown in Fig. 22, is a good kind that is popular with the baker trade. This pumpkin averages from 15 to 20 inches in diameter, and is round or slightly oval in form; the rind is smooth, hard, slightly ribbed, and of a reddish-orange color. The flesh is of an orange-yellow color and of good quality.

**112.** There are also some very large-growing varieties, such as the **Mammoth**, and they are popular for stock feeding and for show purposes. These may also be used for pies, but they are too large for most retail markets. Under intensive culture, some of these pumpkins will grow to a weight of from 100 to 200 pounds.

**113.** Pumpkin seed can be successfully grown anywhere that the plants will do well. The directions given for the production of squash seed apply with equal force to the production

of pumpkin seed. Pumpkins should not be grown for seed purposes near squashes, because some varieties cross very readily, and the seed produced under such conditions is worthless.

**114.** Pumpkins should be planted in hills about 10 feet apart each way. They can be grown most economically in corn fields. In the latitude of New York City they are commonly planted from the middle of May to the middle of June.

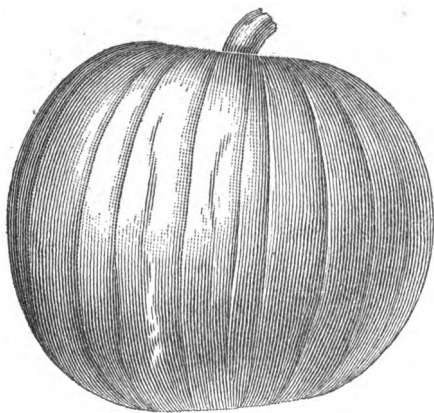


FIG. 22

Usually only one and never more than two plants are allowed to remain in each hill, although from ten to twelve seeds should be planted. The seedlings should be thinned when they are from 6 to 8 inches high. The ground should be kept well cultivated about the vines until the vines grow very large.

**115.** The same insect pests and fungous diseases that attack squashes are found on pumpkins, and they do about the same damage. The method of control is the same as for squashes.

**116.** The market demand for pumpkins is most active in the fall, principally in October and November, when they are largely used for pies and in stores for decoration.

It will seldom pay a grower to raise many pumpkins, because of the limited market for them. From 1 to 3 tons is a fair crop for a single grower to dispose of. Such a crop can be raised with little trouble and expense, especially if the pumpkins are grown as a companion crop with corn, etc. Pumpkins are commonly sold by the pound, and bring from  $\frac{1}{2}$  to 3 cents a pound.

# MELONS

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## MUSKMELONS

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### GENERAL REMARKS

1. **Melon** is a term applied to a trailing plant of the gourd family or to its fruit. There are two species, the **muskmelon** and the **watermelon**. Muskmelons are extensively grown in all parts of the United States by both market gardeners and truck farmers. Watermelons are peculiarly a Southern crop and are, for the most part, grown in large areas on truck farms or as a general-farm crop; they are discussed later under a separate heading.

2. The muskmelon is similar in manner of growth and in general characteristics to the cucumber. Their season begins late in the spring and lasts until cold weather. At the height of the season the consumption of muskmelons is large, train loads from single shipping points finding a ready sale in the large markets.

3. The greater part of the muskmelon crop is grown extensively rather than intensively. In certain sections hundreds of acres are devoted to the crop to the almost total exclusion of other market crops. Certain localities of the United States have become famous as muskmelon-growing centers. Rocky Ford, Colorado, is an example of such a locality; the melons grown in this vicinity, and generally known as the Rocky Ford muskmelons or cantaloups, have become famous all over the

country. The production of muskmelons is also extensive on Long Island, New York, and in the vicinity of Hackensack, New Jersey, where they are handled as field crops. There is some local production in nearly all sections of the country, and the crop is one with which the grower may obtain a reputation and a good profit if he gives it the necessary attention and makes his muskmelons a distinct product in the local markets.

In the vicinity of Montreal, Canada, and Irondequoit, New York, muskmelons are raised very intensively. A large number of acres are devoted to the crop in these localities, although but few growers have more than a few acres each. Many growers in these sections make muskmelons the only or the main market crop. Large quantities of muskmelons are grown in hotbeds in these two sections.

**4. Commercial Importance.**—The muskmelon crop, including cantaloups, is of considerable commercial importance in the United States. According to the census of 1910, it was valued at \$3,604,636 in 1909, raised on 52,419 acres, distributed among 16,278 farms, or an average of about 3.22 acres per farm. This includes only the crop that was raised in patches of 1 acre or more; the total crop is much larger.

Muskmelons are grown to some extent in practically every state in the country. The ten principal states, ranking in the value of the crop produced, are: California, Colorado, New Jersey, Maryland, Florida, Georgia, Indiana, North Carolina, Ohio, and Michigan. These ten states produce more than 66 per cent. of the total crop. California produces about 11 per cent. of the crop, Colorado about 9 per cent., and New Jersey about 8 per cent.

**5.** According to the census figures, the average income per acre from muskmelons for the United States is about \$68. For each of the principal states, the average income per acre is as follows: Ohio, \$92; Colorado, \$84; Michigan, \$80; New Jersey, \$79; North Carolina, \$72; California, \$70; Maryland, \$70; Georgia, \$69; Florida, \$67; and Indiana, \$51. Skilful growers get much higher returns.

**6. Cost of Production and Income.**—The cost of production of 1 acre of muskmelons naturally varies widely with local conditions and with the management. The following estimates of the cost of production for field-grown melons based on the experiences of successful growers, will be of use to beginners:

	MODERATE ESTIMATE	LIBERAL ESTIMATE
Plowing.....	\$ 2.00	\$ 2.00
Harrowing.....	1.00	2.00
Manuring (15 tons).....	15.00	30.00
Fertilizers (1,000 to 2,000 pounds).....	15.00	30.00
Plants grown under glass and setting.....		28.00
Seed sown in field.....	5.00	
Cultivation (four times).....	4.00	6.00
Spraying (five times).....	7.50	10.00
Picking.....	15.00	25.00
Sorting and packing.....	15.00	40.00
Crates.....	15.00	30.00
Total.....	\$94.50	\$203.00

The commission and transportation charges must be added to these figures.

**7.** When a crop of from 100 to 250 crates is secured per acre and it can be sold at prices ranging from \$1.50 to \$4 a crate, the cost of production can be easily covered and a fair to a large profit obtained.

**8.** When muskmelons are grown in frames the cost of production is much higher than the figures given in the estimates, and often run from \$800 to \$1,000 an acre, but because of the high prices received for frame-grown melons, the returns are proportionately large, running from \$1,500 to \$2,500 an acre.

**9. Climatic Requirements.**—Muskmelons are tender to frost and do not do well in cold, damp, weather; they seem somewhat more susceptible to cold than either cucumbers or squashes. To make the best growth, muskmelons require an abundance

of sunshine and a high summer temperature. The crop should not be started in the open until all danger of frost is past.

Muskmelons are produced most extensively on a commercial scale, where the growing season between frosts in the spring and frosts in the fall is long enough to allow fruit to mature from seed sown in the field. The early, quick-growing varieties will not mature a crop in less than 90 days, and some of the other varieties require as long as 120 days. Considerable quantities, however, are started and even grown in some sections under glass, where the outdoor growing season is not long enough. Any means by which the maturity of the crop can be hastened will usually add to the size of the crop harvested and to the net income, because the bulk of the profit is practically always realized from the early sales.

**10.** An ample moisture supply is important for muskmelons, and unless a liberal rainfall can be depended on, irrigation is necessary. Muskmelons, however, will do better in dry seasons than many other crops, particularly if the soil has received deep cultivation during their early growth.

Because of their liking for sunshine and high temperature, muskmelons are profitably produced under irrigation on the arid regions of Colorado, New Mexico, and Arizona. These muskmelons are of excellent quality and bring high prices in Eastern markets. The net profit from muskmelons produced in the East, however, is probably just as high, because of the nearness to market.

**11. Soils.**—Muskmelons succeed best on well-enriched, well-drained sandy loam soils, and the largest part of the commercial crop is produced on such soils. When properly handled, however, muskmelons can be successfully grown on a great variety of soils, and the question of soil is probably less important than the securing of favorable climatic conditions. The usual arguments advanced in favor of a good sandy soil for muskmelons are: (1) The crop reaches marketable size earlier on such soils, (2) sandy soils can be worked more easily than heavier soils, and (3) the muskmelons produced on sandy soils are better than those produced on heavy soils. When properly enriched

and supplied with humus, however, many clay and silt soils have been made to produce large crops of high-quality muskmelons. On account of the large quantity of humus usually present in new land, such soil usually yields good muskmelon crops. The same is also true of muskmelons planted on a newly plowed clover sod.

The supply of moisture in a soil is of the first importance. To produce good crops of muskmelons, the moisture supply must be constant and abundant. A lack of moisture or irregularity in the supply results in a weak vine growth and the production of fruits of inferior quality.

Alkali soils are not suitable for muskmelons. The fruits produced on such soils are commonly of poor quality.

A southern or a southwestern exposure is considered best for muskmelons, because the soil on such slopes will warm up early and tend to hasten the growth of the vines and the maturity of the fruit.

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### CLASSES OF MUSKMELONS

**12.** There are many kinds of muskmelons and the differences between them are often very marked. Muskmelons are classed, according to the color of their flesh, as *cantaloups* and *nutmeg muskmelons*. **Cantaloups** are those muskmelons having orange-colored or salmon-colored flesh; they are usually somewhat oblong in shape and have a hard, furrowed rind. **Nutmeg** muskmelons are those having green flesh; they are usually roundish in shape, have a soft, netted-veined rind, and very sweet flesh. Many other characteristics outside of the color of the flesh have been used as a basis of classification, but these are not now generally used. The muskmelons in each group may be further subdivided as small, medium, and large; as netted and smooth; as ribbed and non-ribbed; as hard-rinded and soft-rinded.

The large number of varieties of muskmelons is due to a certain extent to the fact that the male and female blossoms are borne on different parts of the plants. This makes cross-fertilization necessary; the pollen is carried by insects, principally by bees.

The pollen of any variety will readily fertilize the female flowers of any other, and many undesirable croes are produced in this way.

**13.** The varieties of muskmelons producing fruit with a netted rind are the most popular in the markets. Netted muskmelons are characterized by a net-like pattern of gray ridges which appear on the rind about 2 weeks before they ripen. On some varieties this netting is so thick on the fruit as to shut out completely any undertone of color; on the fruit of other varieties, the netting is sparse. It is often claimed that the heavier the netting, the better the melon; this however, is not always true.

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#### VARIETIES OF CANTALOUPS

**14.** The leading varieties of cantaloups having orange-colored or salmon-colored flesh are: *Osage Orange*, *Emerald Gem*, *Burpee Fordhook*, *Paul Rose*, and *Irondequoit*.

**15.** The **Osage Orange**, or *Millers' Cream*, cantaloup, has become famous in some of the muskmelon sections of the country, particularly those of Southern Michigan, although it is almost unknown in many localities. The vine is a strong-growing plant, matures its fruit in from 12 to 18 weeks, and is productive. The muskmelons are long; the surface is a dark green when immature but turns to a lighter green when ripening; it is prominently ribbed and slightly netted; the flesh is thick, salmon colored, juicy, and of a fine aroma and flavor. The fruit is only a fair shipper and is therefore best suited to a local market. The fruit has one unfortunate defect, which is a tendency to split when growing rapidly or after a rain following a period of drought. The appearance of the *Osage Orange* muskmelons is not so fancy as that of the netted kind, and they will not bring high prices in the markets unless their quality is known. As the quality can be easily demonstrated to a retail or store trade, this is the best outlet for muskmelons of this variety.

**16.** The **Emerald Gem** cantaloup is one of the earliest and most prolific of the salmon-fleshed varieties. The fruit is

nearly round, a trifle flattened on the ends, of an emerald-green color on the outside and somewhat netted. The flesh is thick, the seed cavity being small, and the flavor is extra fine. This is one of the best of the small varieties.

**17. The Burpee Fordhook cantaloup**, illustrated in Fig. 1, is a recently introduced variety that has found favor with many growers. The vines grow strong and set fruit early. The fruit is considerably larger than that of the Emerald Gem and is of a similar shape; the rind has a close netting and is thin, and the seed cavity is small; the flesh is salmon colored, of high flavor, thick and firm, and stands up well, so that the shipping qualities are excellent.



FIG. 1

**18. The Paul Rose, or Petoskey, cantaloup** is a small lemon, the fruit averaging between 2 and 4 pounds in weight. It is nearly round, a trifle longer than broad, ribbed, and heavily netted. The flesh is of a deep orange color, is thick, and the seed cavity is consequently small; the flesh is very firm, of good quality, and the muskmelon is an excellent shipper.

**19. The Irondequoit cantaloup**, illustrated in Fig. 2, is an improved strain of an old variety known as *Sunrise*, and has become very popular in the large muskmelon-producing section around Irondequoit, New York. The vine is a very strong grower and is prolific. The muskmelons reach a marketable

stage later in the season than those of the smaller varieties, but mature early for muskmelons of this kind and size. When well grown, the average muskmelon is large, weighing between 5 and 8 pounds, oblate in form, ribbed, very heavily netted,

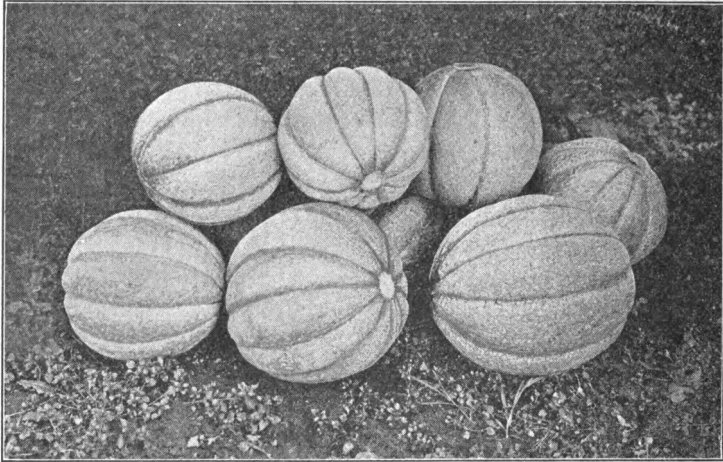


FIG. 2

and has a thin rind and thick flesh. The flesh is of a good salmon color, rather coarse grained, melting, very juicy, and has an exceptionally fine flavor.

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#### VARIETIES OF NUTMEG MUSKMELONS

**20.** The leading varieties of nutmeg muskmelons having green flesh are: *Netted Gem*, *Jenny Lind*, *Extra-Early Hackensack*, and *Montreal*.

**21.** The **Netted Gem** nutmeg muskmelon, shown in Fig. 3, is the original type of the *Rocky Ford* muskmelon, and is often called by that name. There are a number of improved strains of this variety on the market, one seedsman alone offering in his catalog four distinct strains, all of which are said to be superior. Some of these strains are known by such names as *Rocky Ford* (special strain), *Standard Rocky Ford*, and *Improved Rocky Ford*.

The fruit is small in size, the rind is well netted, and the flesh is an attractive green. The vine is a moderately vigorous

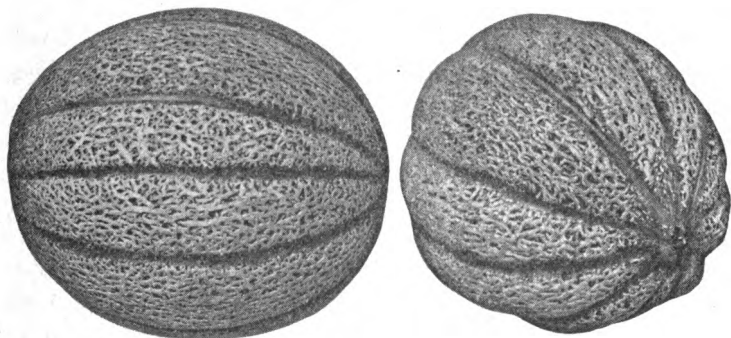


FIG. 3

grower, and is early bearing and productive. This muskmelon is of a size, shape, and quality that takes well in most markets, and, under good management, it yields well enough so that it can be sold for a price which makes its consumption fairly general. It is a favorite variety with truckers.

**22. The Jenny Lind nutmeg muskmelon**, shown in Fig. 4, is a very early variety, and is of particular value for this reason. The vine is not a vigorous grower but is productive. The fruit is small, round, and well netted; the flesh is green and of good quality. There are many improved strains of this variety on the market for which are claimed better qualities than are found in the original.

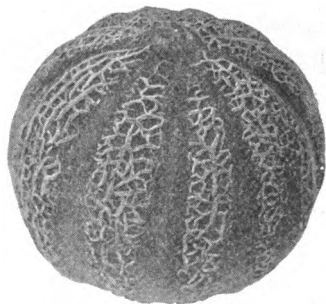


FIG. 4

**23. The Extra-Early Hackensack nutmeg muskmelon** is a variety that originated in the vicinity of Hackensack, New Jersey, and it is grown extensively in that state. The vine is a good grower, and, considering the size of the fruits, produces its marketable product early. The fruit is larger than those of

the Netted Gem or of the Jenny Lind, attractive in appearance, deeply ribbed, and has green flesh of excellent quality. From all points of view this is a first-class variety, and is worthy of a trial wherever a green-fleshed variety is popular.

**24.** The **Montreal** nutmeg muskmelon is one of the largest of muskmelons; the average weight is 8 to 15 pounds, but single melons often grow to a weight of 20 pounds or more. The fruits are of handsome appearance and when well grown are luscious. The vine is a vigorous grower and the muskmelons require about 100 days to reach maturity. This variety is raised more successfully by the gardeners in the vicinity of Montreal, Canada, than elsewhere. As it has not been a conspicuous success in many parts of the United States, its culture should first be attempted only in an experimental way.

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#### SEED AND SEED PRODUCTION

**25.** The feasibility of producing muskmelon seed at home depends largely on whether or not more than one variety is grown in the vicinity. If only one variety is grown, the work of seed production is very simple. But if more than one variety is grown, the work is more complicated, the labor expense is considerable, and the chances of producing inferior seed are high.

One market gardener has been particularly successful in growing muskmelon seed in a locality where only one variety is grown. He has gained an extensive reputation for first-quality muskmelons, and supplies some first-class hotels at first prices. He has bred the variety he is now producing for more than 30 years, and has always grown his own seed, and only the muskmelons that came nearest to his idea of the perfect muskmelon for the variety were saved for seed. In recent years his crop for seed production has been raised on an island where contamination with pollen from other varieties is next to impossible. As a result of care in selection and of the isolation of the seed plants, this grower is able to produce every year crops of muskmelons that are very uniform and of high quality. Such a procedure in muskmelon seed growing is not usual, and would

not be possible in many localities, but where it is possible it is greatly to be recommended.

**26.** The first requisite for successful seed production is to secure pure seed of the variety to be grown; that is, seed that does not contain any admixture of other varieties. There is no way of testing the purity of the seed by an inspection; the seedsman's word must be taken for much. The melons of the first crop should, however, be carefully examined, and unless the great majority of them possess to a marked degree the distinguishing characteristics of the variety to which they are supposed to belong, they should be discarded for seed purposes and a new lot of seed tried.

The second requisite for seed production is to cause the female flowers on the plants to be fertilized by the desired pollen, and to prevent them from being fertilized by any other pollen.

As previously explained, muskmelons have two kinds of flowers on each plant, the male and the female. These flowers are borne on different stems and on different parts of the plant. Bees and other insects will commonly carry the pollen from the male flowers to the female flowers, and without their aid the bulk of the field-grown muskmelon vines would never set fruit. This cross-pollination is perfectly satisfactory so far as the fertilization of the female blossoms and the production of fruit is concerned, but it is objectionable for seed production.

**27.** The most certain method of fertilizing the female flowers with the desired pollen is to apply it by hand. Two important points should be considered in this work: (1) No other pollen than that applied artificially should reach the flower to be fertilized; (2) the desired pollen should be applied at the right time, that is, when both the pollen and the pistil, or female flower, are ripe. To insure fertilization at the right time, the muskmelon flowers should be closely watched. When the end of the pistil expands, which will be soon after the flower opens, it is time to apply the pollen. There are several methods of applying the pollen.

1. The pollen of the male, or staminate, flowers of one plant may be collected on a watch crystal and the female flowers of a

different plant are dipped into the crystal so that the end of the pistil will come into contact with the pollen grains. The use of pollen from a different plant than that on which the female flower grows is necessary in order to maintain the vigor of the strain. The work of pollination is most successfully done on warm, sunny days. For several days after the pistil has been pollinated, the female flower should be protected from being fertilized with pollen from other male flowers. This can be effectively done by enclosing the flower in a paper bag and tying the opening of the bag about the stem on which the flower is borne; the bag should not be tied too tightly or pressed against the flower, or the latter may be injured. The bag should be kept on until the fruit has had time to set, which will commonly be in from 3 to 5 days. If the work has not been properly done or if the weather conditions have been unsuitable, the flower will have died and fallen off by this time.

2. Another way to hand-pollinate muskmelon flowers is to pull off a male flower at the proper stage of ripeness and brush its stamens across the ripe pistil of the desired female flower. This is easily done and is quite satisfactory if the person doing the work is fully familiar with both flowers and can tell when they are ripe enough. The protection of the fertilized blossoms is the same as that previously described.

3. A third, but less satisfactory way of artificial pollination is to transfer the pollen from one flower to another with a camel's-hair brush. The brush is first run over a male flower from which it collects the pollen, and then over a female flower, on the pistil of which some of the pollen is deposited. This method will produce good results if all the flowers are of one variety; if the brush is used on the flowers of more than one variety there is danger of making crosses, as it is difficult to clean all of the pollen grains out of the brush. After they are fertilized, the female flowers need to be protected as previously described.

28. A few days after the pollination has taken place the bags should be removed and an inspection made. If the fruit has set, a shipping tag stating from what plant the pollen that

fertilized the blossom came, the date of pollination, the variety, the strain, etc., should be tied loosely about the stem; usually a stake carrying a similar tag should also be stuck in the ground alongside of the fruit. This double method of marking is to prevent loss of the identity of the fruit. If hand pollination was considered worth while to begin with, this extra work of marking should certainly be considered equally important. Sometimes the tags on the stems and on the stakes are marked with numbers and letters or with combinations of both, instead of writing out all the data. In either event, careful records of all the work should be kept in permanent form, as in a book.

**29.** The work of growing the muskmelons after the proper pollination has been secured is the same as for the regular crop. The work of selecting the muskmelons for seed purposes is, however, important and must be conducted with considerable care.

Two important points are commonly observed in the work of seed selection: (1) The seed is usually taken from those muskmelons that ripen first, especially for plantings that are intended to produce the earliest muskmelons; such seed will have a tendency to produce vines that will mature their fruit early. (2) The muskmelons borne nearest the base of the plant are usually selected; this is done on the assumption that on the vines produced from such seed, a large proportion of the fruit will be borne near the base of the plant—a particularly desirable characteristic, especially in muskmelon vines that are grown in frames.



FIG. 5

**30.** When the high-priced frame-grown melons are to be handled for seed, the selling price is so high that it is desirable not to waste any of the fruits. Hence, a method of extracting the seed without rendering the muskmelon unsalable is

desirable. One grower accomplishes this as follows: When a muskmelon selected for seed gets ripe enough to begin to separate from the stem, it is removed from the vine and stored in a dry place at ordinary living-room temperature until it is fully ripe. Then a section, or plug, about 2 inches square on the outside surface and somewhat tapering toward the seed cavity is cut out of the melon, usually on the side, with a thin, sharp knife. The seeds are shaken out through the hole left when the plug is removed, the plug is fitted back into place, and is held there by a paper label pasted across it. The package in which such a muskmelon is included is then marked to indi-



FIG. 6

cate that it contains a plugged muskmelon. Such muskmelons are sold at once to avoid any chance of their decay. The grower often receives full price for plugged muskmelons sold in this way, and thus secures his seed without cost. Unless the dealer clearly understands that he is getting plugged fruits and can dispose of them quickly, dissatisfaction is sure to occur, because decay is likely to start in such fruits within 24 to 48 hours.

**31.** Muskmelon seeds are fairly large. About 1,600 weigh 1 ounce; 1 quart weighs about 13 ounces. A sample of Netted Gem muskmelon seed is shown natural size in Fig. 5.

Muskmelon seed is rather long lived. On an average it will

retain its power of germination for about 5 years, and the extreme limit is more than 10 years; commercial growers, however, seldom care to use seed more than 1 or 2 years old, because if it has not been kept under the best of conditions, the germinating power in older seed may be injured; many successful growers claim that 2-year-old seed is better than any other, but no accurate experimental work has been done to prove this. High-grade muskmelon seed should be 99 per cent. pure and about 96 per cent. of it should germinate. The average time required for muskmelon seed to germinate is from 4 to 20 days. Muskmelon seedlings are shown in natural size in Fig. 6.

32. When muskmelons are planted in hills at the usual distances, from 2 to 3 pounds of seed is required for 1 acre, and about  $\frac{1}{2}$  ounce is required for about 100 feet of row. Melon seed is not so expensive as the seed of many other plants; the good seed houses commonly retail it in pound lots at from \$1 to \$2 a pound; specially selected seed by well-known growers, however, will often sell for more.

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### PRODUCTION OF EARLY MUSKMELONS

33. To secure the production of as early muskmelons as possible, the young plants are often started in greenhouses or hotbeds and then transplanted to the field. Hotbeds will usually provide the more suitable conditions, as the young seedlings can be hardened off better in them than in a greenhouse.

The three principal advantages of starting muskmelon plants under glass are: (1) Marketable muskmelons can be secured from 7 to 10 or a few more days earlier than when the seeds are planted in the open; (2) the attacks of the serious insect pests, notably the striped cucumber beetle, may be largely avoided, because the insects cannot get at the plants; and (3) by this means it is possible to extend the area over which muskmelons may be grown; that is, by cutting down the length of time the muskmelon plants must be kept in the open, they

may be grown in sections where the growing season is rather short, as in Canada. In all commercial muskmelon sections, the practice of starting muskmelon plants under glass is annually becoming more widespread, because of the increased earliness in the maturity of the crop.

**34.** The seed should be sown under glass about 30 days before the time for field setting. In the latitude of New York, where the plants may be set in the field about May 15, the seed is commonly sown under glass about April 15. The plants should not be kept under glass too long a time or they may become stunted or may receive a severe check when they are set in the field. Some growers claim they get better results by keeping the young plants under glass for 40 to 45 days, but it is questionable whether the average grower will find this so; more labor is also required when they are kept under glass so long, as this will usually necessitate shifting them into larger pots.

**35.** Enough plants to set one hill should be grown together in the same piece of soil. Paper or clay pots, pint or quart berry baskets, and veneer boxes may be used, each containing the plants for one hill; in some cases 3-inch or 4-inch squares of inverted sods may be used for this purpose with almost equally satisfactory results; flats may also be used, in which case a knife is used to cut the dirt out of the flat in blocks so that a good ball of earth can be planted in each hill. The reason for using pots, baskets, etc., is to have the plants in such a condition at planting time that they can be set in the field with a ball of earth around them and with the least possible root injury.

If pots or similar receptacles are used, they should be filled with a light loam soil containing a good supply of humus. From three to four seeds should be planted in the center of each pot and covered about  $\frac{1}{4}$  inch deep. In from 10 to 14 days the plants should be thinned to two in each pot. Some growers prefer to start the plants by sowing the seed in the soil of the hotbed and then transplanting them to pots in about 14 days, but it is preferable to start them in the pots and thin them as described, because mutilation of the plants in resetting is avoided.

**36.** The temperature in the hotbed or greenhouse should be regulated so as to produce a steady, stocky growth with a largely developed root system; the temperature should not be too warm, or the plants will feel the shock of being transplanted to the field more severely. The night temperature should be kept between 45° and 50° F., and the day temperature between 60° and 70° F. If the temperatures are kept much higher than those mentioned the tops will grow too tall and spindling and the root system will not be well developed.

**37.** While in the hotbed the plants should be thoroughly and frequently watered, but not more often than the condition of the soil and the plants indicate is necessary. The soil should be kept moist and the plants growing steadily. Excessive watering that puddles the soil will make conditions favorable for diseases. The watering should preferably be done in the forenoon on clear days.

**38.** For several days before the plants are to be set in the field, they should be hardened off gradually to accustom them to outdoor temperature and weather conditions. This is done by raising the sash and exposing the plants to outdoor conditions gradually, that is, for a short time the first day and increasing the length of the exposure each day.

**39.** The field setting of muskmelon seedlings grown under glass should be preceded by as thorough a preparation of the soil as is necessary for seed planting. Instead of digging a hole for each hill of plants, it is a good plan to make furrows about 3 or 4 inches deep, for the reception of the plants.

The plants should be thoroughly watered before being taken out of the hotbed. They should then be carefully loaded onto a flat-bodied wagon, carried to the field and placed gently beside each hill. The next step is the removal of the plants from the pots. If this is necessary, it must be carefully done so as not to loosen the soil about the roots; if the plants have been previously well watered and care is exercised, the soil will adhere well and not fall away from the roots. If the plants have been grown in clay pots, they can best be removed by

placing the fingers across the pot, with the plants between the third and fourth fingers, inverting the pot, and tapping the edge gently on some solid object or on the ground. If the plants have been grown in paper pots or in berry baskets they need not be removed; the bottom is simply cut out of the container by slitting it around the lower edge with a sharp knife; when handled in this way, there will be no danger of a serious root disturbance. Boys can readily do this work. Plants grown on inverted sods are set directly in the ground with the sod.

Setters should follow closely after those who remove the plants from the pots. Those who remove the plants from the pots must be careful not to snap or bruise the stems of the seedlings or break the cake of earth about the roots. Each clump of earth containing a hill of plants, should be set in the furrow at the proper point, and soil packed around it on all sides. The hill should not be much higher than the level of the surrounding soil, because if it is the rain will wash the soil away, and the sun will dry it out too much about the plant roots.

The cultivation and general care is the same as for plants produced from seed sown in the field..

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#### PRODUCTION OF LATE MUSKMELONS

40. Early preparation of the land intended for late muskmelons is advisable. On many soils, fall plowing is a good practice, but if the land is so located that washing would be likely to occur, this had better be deferred until spring. As the late muskmelon crop cannot be put in the field until about the middle of May in the latitude of New York, there is plenty of time to give the land intended for muskmelons treatment which will sufficiently mix both stable manure and commercial fertilizer with the soil and give the sunshine a chance to warm up the ground. The preparatory treatment should be conducted with the idea of conserving all the moisture possible, because moisture is almost never too abundant in the sandy soils suited to muskmelons; also, this preparatory tillage should tend to make available all the elements of plant-food and to have them well

distributed in the soil water. To accomplish these things, the land should be frequently harrowed from the time it is plowed until the crop is planted, and a crust should never be allowed to form on the surface; one harrowing a week should be enough.

Perhaps the ideal method of preparation will commence with plowing under a clover sod in the fall. Whether this is done or not, about 20 tons of stable manure, preferably of well-rotted stable manure, should be broadcasted over the land during the winter or early in the spring and plowed in; in localities where large quantities of stable manure are not available, growers have to be content with plowing under a green manure crop. After this about 1,000 pounds of a commercial fertilizer analyzing 2 per cent. of nitrogen, 8 per cent. of phosphoric acid, and 8 per cent. of potash should be broadcasted and harrowed in with a disk harrow.

**41.** The time for planting muskmelon seed varies somewhat with the latitude and with the locality. In the latitude of New York, it is not advisable to plant them before May 15, and from then on until June 15; they should not be planted in the open until danger of frost is past. In Michigan, the earliest date of planting is the latter part of May or the first part of June. In the trucking sections around Norfolk, Virginia, they are planted in April.

**42.** Immediately before the time for planting muskmelon seed in the field, a final finishing harrowing should be given. Following this, the ground should be marked for planting, the field being marked both ways and the plants set in hills at the intersections of the marks. The hills should be spaced 6 feet apart one way and 4 feet apart the other way; this will provide room for about 1,815 hills per acre. Some growers prefer to space the hills 6 feet by 5 feet, but as this will allow only about 1,450 plants per acre, the possibilities of a large yield are reduced, and the plants do not do enough better at the wider spacing to warrant this, especially on expensive land.

**43.** It usually pays to give the hills where the seed is to be sown some special preparation, even on rich soil. This usually

consists of forking from 15 to 25 pounds, from two to three good forkfuls, of well-rotted stable manure into each hill and mixing it deeply with the soil for a radius of 12 to 15 inches. This will provide a rich, humus-filled bed for the seedling plants and induce a strong, rapid growth, which will tend to force an early maturity of the crop. The cost of application of this manure is somewhat high, but the results in practically every case warrant the expenditure.

44. The next step is to plant from fifteen to twenty seeds in each hill. This should follow quickly after the forking in of the manure, and must be done by hand. The seed should not come into direct contact with the manure; to avoid this, a small quantity of fine, rich soil should be placed on the top. The soil should first be firmed well in the hill; this is usually done by tramping with the feet. The required number of seed should then be dropped in place, covered with from  $\frac{1}{4}$  to  $\frac{1}{2}$  inch of soil, and firmed again by tramping. With the ground warm, as it will be if it has been prepared as previously described, the seed will germinate quickly, and the seedlings should break through the ground in about 1 week.

For the first 2 weeks after the seedlings begin to show, every effort must be made to prevent insect injury in the same way as recommended for cucumbers. At the end of this time the danger from insect attack will be largely past and the plants should be thinned to two, or sometimes three, in a hill.

If the plants do not take hold and grow as rapidly at the start as they should, a handful of high-grade fertilizer scattered around each hill will stimulate the proper growth. The fertilizer should be scattered evenly around on the hill and raked in.

45. Frequent cultivation from the time the seedlings break ground is essential to the best development of the vines and fruit. This is best done with a shovel cultivator, and for the first few times at least should be done both ways of the field; when the vines have run to considerable length, the cultivation should be confined to the wider spaces.

The cultivator teeth should be run rather deeply at first so as to stir the soil to a good depth, but as the vines develop the

cultivations should be made more shallow so that the roots will not be injured. Tillage should be continued until the vines so cover the ground that injury will result from the use of the cultivator. To lengthen the period of cultivation as much as possible, the vines may be laid along the row and tillage carried on in one direction only until further growth prevents.

46. Many growers practice nipping back the leader, or the end of the main part of the vine, after it has grown to a length of 4 or 5 feet. This stops growth of the main stem and stimulates the growth of the laterals, on which most of the pistillate flowers are borne and also the growth of the fruit; it is from the pistillate, or female flowers, that the fruit develops.

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#### PRODUCTION OF MUSKMELONS IN HOTBEDS

47. In recent years considerable attention has been given to growing muskmelons of certain varieties in hotbeds, especially in northern localities where the growing season is too short to allow of their culture outdoors year after year without the loss of a crop now and then from frost either in the spring or in the fall. This method of growing muskmelons has been stimulated because of the high prices secured by the growers in the vicinity of Montreal, Canada. The Canadian growers have held for a long time that muskmelons could be successfully raised only in the comparatively small area around Montreal. But tests have shown that they can also be successfully grown in the northeastern part of the United States, provided the crop is handled as skilfully as it is by the Montreal growers. No doubt many other Northern parts of the country will also be found suitable for raising this crop.

The following favorable factors induce some growers to produce these high-quality melons for market rather than others: (1) The demand is much greater than the supply and seems to be constantly increasing. (2) Although the cost of production is high, the prices are also high, and under proper management the net profits are correspondingly high; gross returns of from \$1,500 to \$2,500 per acre have been secured by skilful growers,

and the net profits from such gross returns are from \$800 to \$1,500 an acre; such returns, however, are not possible unless all conditions are favorable and the management is such as to take full advantage of all favorable conditions.

Two sets of hotbeds are used for producing a crop of muskmelons in these localities. The young seedlings are grown to transplanting size in one set, and then are transplanted to another set with sectional frames which cover the beds where the marketable muskmelons are produced.

48. The hotbeds in which muskmelon seedlings are started are of the common type, and have been previously described; they should be well constructed so that they will retain the heat satisfactorily, well exposed to the sun's rays, and protected from cold winds. In localities where the winters are especially severe, as in the vicinity of Montreal, special protection will be needed. Many growers put two layers of sash over the frames, to form a dead-air space to keep out the cold; sash containing a double layer of glass with an air space between them are now being experimented with. Straw mats and board shutters may also be necessary at night even over the sash with the double glass. When the sash are covered with mats and shutters and the manure in the bottom of the hotbed is sending up the required amount of heat steadily, the seedlings should do as well in a hotbed as in a greenhouse.

Many of the growers in the vicinity of Montreal claim that plants started in a greenhouse never give as satisfactory results as those grown in a hotbed. There does not, however, seem to be any good reason for this if the greenhouse is well constructed and properly managed.

49. In the vicinity of Montreal, the seed is sown either in the soil of the hotbed or in 4-inch pots in a hotbed, with 15 or 18 inches of heating manure under the bed, or in a greenhouse, from the last part of February until about April 1; one of the largest and most successful growers in that section plants the seed for his earliest crop the latter part of February or the first part of March. In Vermont, good results have been secured from planting the seed about April 15. The exact date for the

first planting will vary not only with the latitude but also with local conditions.

**50.** If the seed is first planted in 4-inch pots, the seedlings are thinned to the two strongest when they are an inch or two high. If the seed is planted in the bed in the frame, the seedlings are transplanted to 4-inch pots as soon as they are large enough to handle, two strong seedlings being placed in a pot. If the seed has been sown extremely early and the plants begin to crowd in the 4-inch pots before time for setting them in the second set of frames, they are usually shifted to 5-inch or 6-inch pots.

When properly handled, muskmelon seedlings will be ready for transplanting to the second set of frames in about 1 month after the seed is sown. They should be set in these frames before they are in danger of suffering for a lack of root space and plant-food in the pots.

**51.** The second set of frames in which the crop is matured are made in the Montreal section so that they can be raised late in the season when the plants require more ventilation, or removed entirely. They are commonly made in sections 12 feet long and 6 feet wide; they will then accommodate four 3' × 6' sash. The frames are strongly and tightly made and tie-rails are provided for the sash to rest on. In some cases the frames are made 16 feet long and 6 feet wide, and 4' × 6' sash are used, but this is not common.

These movable frames are set on beds of earth from 12 to 16 feet wide, and as long as required, according to the number of frames to be set. The beds are slightly higher through the middle than at the sides, so as to provide good drainage; the middle is about 1 foot above the surface of the surrounding soil. A trench about 2 feet wide and from 15 to 18 inches deep is dug through the middle of the bed, the depth depending on the earliness of the season, more manure being required for the early plantings. The trench is filled with good fermenting manure. The manure is covered with part of the soil that was taken out of the ditch, usually to a depth of about 3 to 4 inches; the soil where the plants are to be set should be made a little

thicker than the rest of the covering. This is probably the most economical way of using manure in muskmelon hotbeds, because it is placed only directly beneath the plants; it is the method commonly used by the Montreal growers.

A common hotbed with a manure pit 10 inches deep at the middle, and about 4 inches deep at the front and back edges, has also given good results with muskmelons.

**52.** The frames are set in place as soon as the bed has been prepared; about 4 to 6 feet should be left between the ends of adjacent sectional frames, and no manure need be placed under these open spaces. The frames should be immediately banked on the sides with earth or manure, or both, and covered with glass sash and these reinforced with straw mats and wooden shutters, or merely with a covering of hay or straw if the former are not available. The frames should be kept covered in this way until the interior has warmed up sufficiently for receiving the young plants.

On the first favorable day after the hotbed has warmed up sufficiently, the muskmelon seedlings should be set in it. The warmest part of the day should be selected, and great care should be exercised to prevent checking the growth of the plants by a sudden change to a colder soil or atmosphere than that from which they have been taken.

A single hill is commonly made at the center of the bed under each sash. When four 3' × 6' sash are used, four hills are made in a frame; when three 4' × 6' sash are used, three hills are put in a frame. Two plants are commonly placed in each hill.

**53.** When most seedling plants are set in their permanent places of growth, it is seldom necessary to give them the special care they had in the seed-bed. But in the case of muskmelons, and particularly Montreal muskmelons, the seedlings require even more care in the movable sectional hotbeds than they do in the seed-bed; on account of the much greater area covered by these movable hotbeds, the later work is much harder and the maintenance of the proper conditions much more difficult.

The following details of management of muskmelon vines in their permanent places in movable frames should be carefully

attended to; because much of the success in muskmelon production depends on keeping the plants healthy, growing vigorously, and free from insects, and the work of maintaining these conditions under glass requires greater care and skill than it does outdoors.

1. As the warmth of the sun increases with the advance of the season, particular attention must be paid to watering and ventilation. The plants must always be kept supplied with sufficient moisture to insure a rapid growth, but so much should not be applied as to make conditions favorable for the growth of fungi. The temperature should not be allowed to go much above 75° F. during the day and should be kept about 20° F. lower than this during the night. The temperature can be regulated by lifting the sash and the frames, and by watering. On bright sunshiny days, a somewhat higher temperature than 75° F. can be safely maintained without danger of an invasion of red spiders or thrips if water is frequently applied to the soil in the form of a fine spray; some growers use a large syringe for this purpose. Subirrigation of the soil in the frames has been tried with success, but the results were not markedly different from those in adjacent frames watered in the ordinary way.

2. As the fruit becomes fairly well developed, and particularly when it is nearly full grown, it should be kept up off the ground by being placed on a piece of board, a flat stone, a piece of wire gauze, or some similar object.

3. The uniformity of shape, color, netting, and ripening, which is essential in high-priced melons is obtained by turning the fruit every few days so that all sides will be equally exposed to the sun. This practice also prevents much of the loss that would otherwise be sustained from cracking, rot, etc.

4. The plants should be carefully inspected every day during the time of pollinization of the blossoms. Sometimes the supply of pollen is deficient, and difficulty may be experienced in getting the fruit to set. In such a case, thorough hand pollination must be practiced; that is, the pollen should be shaken out of the male flowers onto a watch glass and transferred directly to the female flowers by dipping them into it.

5. The central shoot of each plant is commonly pinched out in order to prevent the plant from running out too far. The plant will usually do better when this is done, but it is not essential to successful production.

6. As each fruit sets, the shoot, or runner, on which it is growing is pinched off one or two nodes, or joints, beyond it. This is necessary so that the full strength of the runner will go into one fruit and produce a large one. Usually, not more than fifteen to twenty melons are allowed to set on the plants in one 6'  $\times$  12' frame. With four hills and eight plants to a frame, this will not allow more than three muskmelons on any one plant; the largest number should be allowed to set on the most vigorous plants.

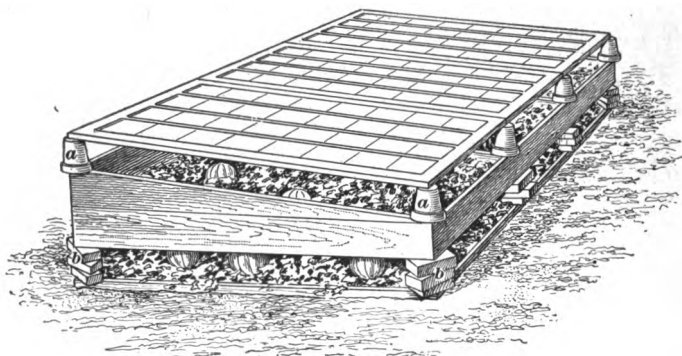


FIG. 7

7. As the weather grows warmer and the plants have spread to occupy most of the area in the sash, the sectional frames may be raised a few inches above the bed on bricks *b*, Fig. 7; during the daytime the sash may also be raised on inverted pots *a*, or on blocks. As the season advances, more and more air is allowed in the frames, until finally the frames and sash are entirely removed; the removal of both frames and sash does not usually occur, however, until the fruits are almost fully developed. In localities where there are strong winds, the raising of the frames and sash in this way would not be practicable unless the frames and sash were braced with strong stakes, and even these might not be sufficient.

### INSECT PESTS AND INJURIES

54. The insect pests that attack muskmelons are the same as those that attack cucumbers, and are equally injurious. They are one of the big obstacles in muskmelon production. The principal insect pests are: the *striped cucumber beetle*, the *spotted cucumber beetle*, the *melon aphid*, and the *melon worm*. A full description and a discussion of the most effective methods of control for these insects is given in *Cucumbers and Squashes*.

Fungous diseases affect muskmelons to about the same degree as they do cucumbers and are of the same sorts; the principal ones are the *downy mildew*, or *cucumber blight*, *sclerotium* and *cucumber wilt*. In some localities, successful muskmelon production has been entirely prevented by the action of the blight. The methods of preventing injury from blight is discussed in *Cucumbers and Squashes*.

A selection of varieties of melons for rust resistance has been carried on with some success and varieties are now offered that are claimed to be rust resistant, or even rust-proof. Further experience is necessary with these, however, before their full value can be determined.

Bordeaux mixture is the most effective fungicide for preventing injuries from the fungous diseases of muskmelons.

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### HARVESTING AND MARKETING

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#### HARVESTING

55. The time for picking muskmelons depends on the variety and on the length of time before the product will reach the hands of the consumer. To know just when to harvest a muskmelon so it will be of good quality when it reaches the consumer and yet will be firm enough to stand shipping well, is one of the most important details of muskmelon production; unfortunately, the determination of the best time for picking can be learned only by personal observation and experience under

each set of climatic conditions. If picked too early, a muskmelon will not have the aroma, flavor, and quality that belongs to a well-ripened muskmelon; if picked too late, it will be beyond its best stage before it reaches the consumer. Three important points are commonly considered in deciding on the best time for picking muskmelons; when the proper time for picking approaches: (1) the rind will lighten or yellow somewhat in color; (2) a more or less distinct, agreeable odor can be detected when the melon is held to the nose; and (3) the stem will show signs of loosening from the fruit. Although these important points can be stated in a few words, experience is required to apply them rapidly and successfully while the fruits are being harvested.

**56.** The harvesting of muskmelons continues from the time the first fruits are ripe until the vines stop growth from injuries from frost or diseases. For the larger varieties, a good yield is five marketable fruits from a hill, or about 9,000 fruits per acre. The smaller varieties are somewhat more prolific, and yields of 12,000 to 15,000 fruits per acre are not exceptional.

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#### MARKETING

**57.** Quality is all essential in the marketing of muskmelons, especially if reorders are to be secured. Muskmelons of high quality will almost invariably meet with an active demand at good prices, and at the same time there will be no demand for those of poor quality. This is especially true in a retail market and also to a less extent in a wholesale market. The appearance of muskmelons is of less relative importance than the quality, although, of course, an attractive rind free from blemishes will help to attract buyers. Usually, muskmelons with a netted rind will sell quickest, although little difficulty is experienced in selling muskmelons regardless of the character of the rind if the sample offered for test is of high quality.

**58.** Muskmelons are marketed in a variety of packages. In the New York wholesale markets, the bulk of them are received in 12" × 12" × 24" slatted crates holding about

forty-five fruits; the number of melons will necessarily vary with their size. In many local markets,  $\frac{1}{2}$ - and  $\frac{5}{8}$ -bushel baskets are used.

The larger Montreal muskmelons are commonly sent to distant markets in large wicker baskets closely resembling a common clothes basket. These baskets will hold 1 dozen of the large muskmelons, and the fruits are packed in them in short, fine-stemmed hay. The tops of these baskets are sometimes covered with burlap, but more often they are shipped without a cover; in either case the express company is held responsible for their safe delivery. Some growers prefer to ship these large Montreal muskmelons in a strong, rather flat wooden case of sufficient depth and length and width to hold a single layer packed four by three in the layer and enough hay to make them carry well. When properly packed in such a case, the fruit will carry long distances without any injury. As the well-grown Montreal muskmelons will average from 8 to 15 pounds each in weight, a dozen packed for shipment will, on an average, weigh from 120 to 130 pounds; some of these muskmelons have been sent to market that would average from 200 to 240 pounds to the dozen. The quality of the extra-large melon is seldom as high as that of those that weigh from 120 to 130 pounds per dozen.

**59.** When intended for sale in most local markets, muskmelons are not graded at all. When they are sent to the larger markets where competition is keen, they should be sorted into two or three grades; only those of one grade should be packed in a crate, and the crate should be labeled and sold accordingly.

**60.** The price of muskmelons varies widely in the larger markets, the fluctuations being due to (1) the supply, (2) the quality of the fruits, and (3) the condition of the muskmelons on their arrival in market. Muskmelons are rather perishable, and their quality and appearance are likely to deteriorate rapidly. Even in times of full supply, muskmelons of high quality and attractive appearance will sell for good prices. Apparently, the demand for first-class muskmelons has never been oversupplied to any serious extent.

In the New York wholesale markets muskmelons are commonly sold by the crate; occasionally they are sold by the basket; very seldom are they sold loose by the dozen.

Muskmelons are found in the larger markets from May to October, inclusive. Those received in May are not of the best quality and bring only fair prices. The highest average prices are received in June, July, and August, after which the prices decline somewhat until the end of the season. The extreme prices vary from about 15 cents to about \$10 a crate; the average low price is about 33 cents and the average high price about \$4.88 a crate.

**TABLE I**  
**PRICES OF MUSKMELONS IN THE NEW YORK MARKETS**

Month	Per Crate			
	Extreme Prices		Average Prices	
	Low	High	Low	High
May.....	\$2.00	\$3.00	\$2.00	\$2.83
June.....	.50	7.00	1.00	4.68
July.....	.25	10.00	.55	4.88
August.....	.15	8.00	.33	4.43
September.....	.25	6.00	.33	3.43
October.....	.25	4.50	.60	2.85

61. Table I shows the monthly low and high extreme and average prices of muskmelons in the New York wholesale markets for the 10 years from 1903 to 1912, inclusive. These prices are computed from the average of the low and the high prices on the first and fifteenth of each month for the decade. They indicate plainly that the early muskmelons bring the best returns and that the best chance of profit lies in getting the crop to market before the bulk of the crop comes in.

The large Montreal muskmelons are usually sold singly, and first-class specimens bring from \$1 to \$3 each, according to size, appearance, and the supply in the market.

In many local markets, the price of Netted Gem, or Rocky Ford, muskmelons varies from \$1 to \$5 a crate. When sold in small quantities, muskmelons of good quality sell in local markets for from 30 cents to \$2 a dozen; in sales to a local trade the reputation of the grower counts for much.

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## WATERMELONS

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### GENERAL REMARKS

**62.** Watermelons belong to the same botanical family as do all the vine crops, but, in spite of the similiarity of the name, they are no more closely related to the muskmelons than are the squashes. Watermelons are, however, often called melons, especially in the sections where they are extensively cultivated.

Watermelons are peculiarly a Southern truck crop. They are native to South Africa and are naturally a tropical crop. The quick-growing varieties may be produced in all parts of the country, but the greatest commercial success can be achieved only in the South Atlantic States. Georgia has long been noted for its watermelons; they are grown in that state by the hundreds of carloads for shipment to the Northern markets. Arizona, and some of the other Western States, are beginning to grow watermelons more extensively than a few years ago.

**63.** Watermelons are more popular on the truck farm than on the the market garden for two reasons: (1) They are large-growing plants and take up too much room for the returns that can be secured; (2) they can be so cheaply grown on truck farms, particularly in the South, that the prices are comparatively low, and the market gardener must raise crops on his high-priced land that will yield a higher return. Watermelons may be grown to advantage in home gardens in all parts of the United States. They furnish a pleasing dessert in their season.

**64. Climatic Requirements.**—When the proper cultural methods are practiced and the proper varieties are selected,

watermelons can be successfully grown in all parts of the United States. They are, however, more sensitive to cold than muskmelons, and most of the varieties require a somewhat longer season in which to mature. The ideal climatic conditions for watermelon culture are found in the South, where the growing season is long, the temperature during both the day and the night is high, and the plants are seldom subject to frost.

**65. Soils.**—Watermelons are grown on many different kinds of soils, but the ideal soil is a well-drained light sandy loam underlaid with a subsoil that is fairly retentive of moisture. This crop does not need a soil abundantly supplied with humus; in fact, the vines are considered to yield a larger and better crop when such is not the case. A green-manure crop or cowpeas or soybeans will supply sufficient humus, and will also increase the supply of nitrogen in the soil; watermelons do especially well after a cowpea sod has been plowed under.

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## VARIETIES, SEED, AND SEED PRODUCTION

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### VARIETIES

**66.** Varieties of watermelons are numerous and new ones are constantly appearing. At least a hundred varieties are listed by American seedsmen, but the majority are of comparatively little value.

Watermelon varieties are not very stable. Few of the leading varieties 10 years ago are leading varieties today. Old varieties are continually running out and are being discarded for improved ones. Although this same thing is true, to a greater or less extent, of all vegetables, it is markedly noticeable in the case of watermelons. For this reason the up-to-date watermelon grower needs to be constantly trying out new varieties.

**67.** A few varieties, however, have stood the test of time and survive because of their distinctly superior market or edible qualities, or both. *Tom Watson, Georgia Rattlesnake, Sweetheart,*

*Cuban Queen*, and *Dixie* are the best of these, and have been standard varieties for years. All are of the late, or long-season, kinds, are suitable to the growing season in the Southern trucking sections, and are popular in the Northern markets.

68. The **Tom Watson** watermelon, shown at the bottom, in Fig. 8, is large, solid colored, and dark green; it grows to a weight of from 40 to 75 pounds, and is from 1½ to 2 feet long and about 1 foot thick, when full grown. The rind is of medium thickness, tough, and of the right quality to insure the fruit

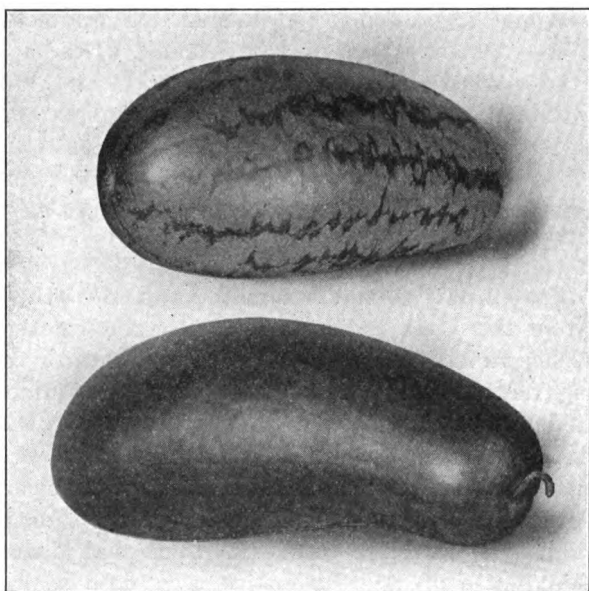


FIG. 8

standing up well in shipment. The flesh is an attractive red, crisp, and of good quality. The seeds are brown tipped with white. The combined splendid appearance and high quality of this watermelon has placed it at the top of the list as a market variety. It is suitable for growing only in Southern localities and will not do well in the North.

69. The **Georgia Rattlesnake** watermelon is another very popular market variety; it has held a leading place for

years. The fruit is oblong and rather large, weighing from 30 to 50 pounds. The rind is mottled and tough. The flesh is highly colored, and of splendid quality. The seeds are white. The vine is a vigorous grower and produces abundantly. No mistake will be made by growers in the watermelon-growing sections of the South Atlantic and South Central States in selecting this variety for market production. It is also a suitable variety for the home garden in these sections.

**70.** The **Sweetheart** watermelon, shown at the top in Fig. 8, was first introduced to the trade in 1894, and has grown steadily in popularity until it has attained a leading place among the market varieties. It is oval and large, weighing from 40 to 50 pounds. The rind is striped with light and dark green; it is thin but tough and the melon is a good shipper. The flesh is bright red, juicy, and very sweet, and remains of high quality longer after it is picked than almost any other kind. The seeds are black.

**71.** The **Cuban Queen** was introduced into the United States from the West Indies about 1881, and for the past 20 years has ranked among the leading varieties for market. This long-continued popularity stamps it as a watermelon of distinction, but it is now being somewhat displaced by the Tom Watson, the Georgia Rattlesnake, and Sweetheart varieties. The fruit is somewhat smaller than that of these three varieties, weighing from 25 to 40 pounds; the fruit is oblong in shape and tapers slightly toward the stem end. The rind is comparatively thin, but tough, and the quality of the flesh is good.

**72.** The **Dixie** watermelon is very similar in shape, size, and markings to the Sweetheart and the Cuban Queen, and, although it is popular in some localities, it is now being rather rapidly superseded by other and better varieties. The fruit is oblong in shape, and will average slightly larger than the Cuban Queen; it weighs from 30 to 40 pounds. The rind is dark green striped with a lighter green, and is thin but tough, thus making it a fairly good shipper. The flesh is of fairly good quality.

**73.** Other varieties that are popular in some localities of the South for the production of watermelons for shipment are: The **Alabama Sweet**, which is earlier than the larger kinds and a fairly good shipper; **Kolb's Gem**, which weighs from 30 to 40 pounds, is a good shipper, and is of fair quality; and the **Florida Favorite**, which is a long, medium-sized, striped variety of fair shipping quality.

**74.** For long-distance shipments, the following scale of points has been found to represent the qualities most satisfactory in watermelons:

Shipping qualities.....	35
Size.....	25
Productiveness.....	15
Quality of flesh.....	10
Earliness.....	8
Shape.....	4
Color of flesh.....	2
Color of rind (including markings).....	1
Total.....	100

As 60 points are given to shipping qualities and size, it can be readily seen that the market varieties best suited for growth in Southern trucking fields are those that will stand rough handling and are big. In watermelons produced for a local market, the quality of the flesh is a much more important factor.

**75.** The earlier varieties of watermelons that are grown in the South for an early market or in the North in home gardens, or in small patches, are, as a rule, poor shippers, but they have excellent edible qualities and are splendid for the home garden as well as for the local market. Three of the best known of these varieties are the *Harris Earliest*, *Kleckley Sweet*, and *Halbert Honey*. The *Coles Early* and the *Fordhook Early* are also good varieties that are less well known. There is a scarcity of first-class, short-season varieties of watermelons.

**76.** The **Harris Earliest** watermelon, shown in Fig. 9, is slightly oval in shape and is large for an early variety, the

fruits probably averaging between 15 and 25 pounds in weight. The rind is thin, and is striped with light and dark green. The



FIG. 9

flesh is bright red and is of good quality for such an early variety. The seeds are black.



FIG. 10

77. The **Kleckley Sweet** watermelon, shown in Fig. 10, and the **Halbert Honey** watermelon are very similar in shape

and markings; certain strains of these varieties so closely resemble each other that none but an expert can tell them apart. Both are long, solid-green melons of the Tom Watson type, and the rinds of both are too tender to stand long-distance shipment; the fruits of the Halbert Honey are slightly longer, and possibly a little deeper green than those of the Kleckley Sweet. The seeds of both varieties are white.

**78.** The **Coles Early** is frequently listed by seedsmen as one of the best of the early varieties, but this and the Harris Earliest are so nearly alike, that few growers are able to distinguish between them. The Coles Early is an excellent watermelon of good quality and may be planted for the same purposes as the Harris Earliest.

**79.** The **Fordhook Early** is frequently listed by seedsmen as one of the best watermelons for the early market and for growth in the North. The fruit is nearly round, weighs from 10 to 15 pounds, and has a thin but rather tough rind, which makes it a good shipper; the rind is dark green. The flesh is red, crisp, and of good quality for an early watermelon. The seeds are white.

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#### SEED AND SEED PRODUCTION

**80.** As compared with other vegetable seeds, watermelon seed is large. From 125 to 150 will weigh 1 ounce, and 1 quart will weigh about 16 ounces. A sample of Sweetheart watermelon seed is shown in actual size in Fig. 11.

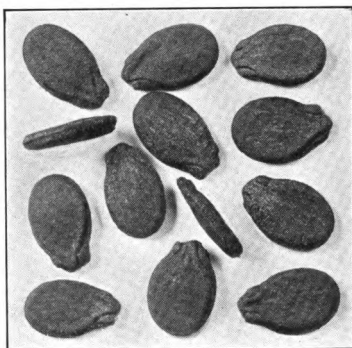


FIG. 11

Watermelon seed is somewhat longer lived than muskmelon seed. On an average, it will retain its power of germination for about 6 years, and the extreme limit is about 10 years. Commercial growers, however, do not usually plant seed more than 1 to 2 years old, because seed older than that, especially if it

has not been kept under the best of conditions, will probably have poor vitality. High-grade watermelon seed should be 99 per cent. pure and about 96 per cent. should germinate. The average time required for watermelon seed to germinate is from 7 to 20 days; much depends on the temperature and moisture conditions in the soil. Watermelon seedlings are shown in natural size in Fig. 12.

**81.** When watermelons are planted in hills at the usual distances, from 4 to 5 pounds are required to plant 1 acre, and about 1 ounce is required for about 100 feet of row. Watermelon seed is comparatively cheap. Reliable seed houses commonly retail it in pound lots for from about 85 cents to \$1.25 a

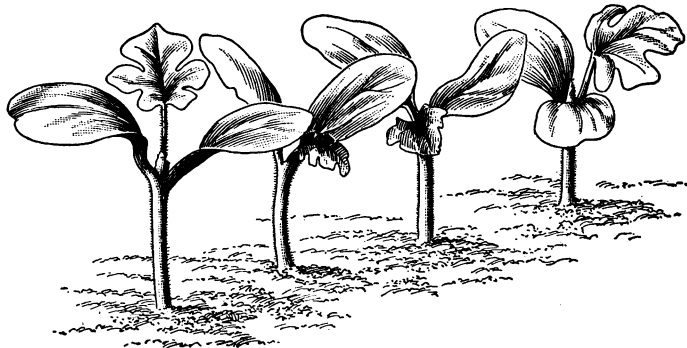


FIG. 12

pound. Seed of new strains or from well-known growers will sometimes sell for a little higher price.

**82.** The same directions that were previously given for the production of muskmelon seed apply with equal force to the production of watermelon seed. Watermelon seed can be successfully produced anywhere the crop can be successfully grown commercially.

#### PLANTING AND GENERAL OPERATIONS

**83.** The preparation of a soil for watermelons should consist of a shallow plowing, about 4 or 5 inches deep, followed by a thorough harrowing. If manure has been applied, it should be well mixed with the top soil before the seed are planted.

The time for planting watermelon seed varies considerably with the latitude. In the latitude of New York City, watermelon seed is sown in the open from the middle to the latter part of May. In the trucking sections about Norfolk, Virginia, it is sown in April. In Georgia, it is sown about the middle of March. As the vines are injured by even a slight frost, the seed should not be sown until all danger of having the seedlings nipped by the frost has passed.

84. Watermelons are planted in hills 7 feet by 7 feet, 8 feet by 8 feet, and sometimes 10 feet by 10 feet; occasionally some of the more vigorously growing varieties are planted even farther apart. The land should be marked out with lines running both ways, and the seed planted in hills at the intersection of the marks.

85. From 500 to 800 pounds per acre of a fertilizer analyzing 3 per cent. of nitrogen, 8 per cent. of phosphoric acid, and 10 per cent. of potash is sometimes scattered broadcast over the ground. Other growers prefer to sow it on a 4-foot strip on either side of the hills after the seed is planted and cultivate it in. The latter practice will doubtless be preferable on most soils.

As recommended for muskmelons, one or two forkfuls of well-rotted stable manure should be placed in each hill, thoroughly mixed with the soil, and covered with about 2 inches of soil. This will give the plants a quick start and will tend to force an early maturity. Unfortunately, most truckers do not have well-rotted stable manure in sufficient quantities; they must rely on cover crops for humus, but these will not, of course, warm up the soil like manure.

86. The planting of the seed is commonly done by hand or a hoe may be used to loosen up the soil and cover the seed. When field mice or other pests are likely to destroy the seed, it is best to plant them over a space 12 to 15 inches square, and to sow from ten to twenty seed in a hill. In hand planting, the seed is pressed about  $\frac{1}{2}$  inch under the surface one at a time, and then covered by hand. In planting with a hoe, a spot of

ground 12 to 15 inches square is loosened up, from fifteen to twenty seeds are scattered over it, and then from  $\frac{1}{2}$  to 1 inch of soil is thrown over them with the hoe and tamped down with this implement.

**87.** Later on, when the plants are several inches high, they should be thinned to the two best plants in the hill. The difficulty of getting a good stand of plants at first makes a liberal use of seed necessary.

**88.** The cultivation of watermelons begins soon after the seedlings appear above ground, and is kept up until it is likely to injure the vines. It is not advisable to move watermelon vines and hence cultivation cannot be safely continued later than would be permitted by the normal growth of the plants. More injury will usually be done by the handling than the benefit secured by the extra tillage.

It is a good practice to make a thin seeding of soybeans, cowpeas, or vetch between the watermelon rows at the time of the last cultivation, in order to prevent the wind from blowing the soil on the vines. Any one of these crops between the rows will shade the watermelon plants somewhat at the time the fruits are ripening, and will thus have a beneficial influence. After the watermelon crop is harvested, the crop between the rows may be plowed under, and will serve to increase the organic matter and nitrogen in the soil. Often this second crop of plants is allowed to grow until late in the winter or early the following spring before it is plowed under.

**89. Insect Pests and Injuries.**—Watermelons are attacked by the same insect pests that attack muskmelons. The methods of control of these pests have been previously given.

The watermelon is singularly free from fungus diseases. Commercial growers never find any necessity for spraying for such troubles, nor for practicing any other methods of control.

## HARVESTING AND MARKETING

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### HARVESTING

**90.** As is the case with muskmelons, some experience is necessary before the right time for picking watermelons can be determined accurately and quickly. The following tests for ripeness are made by different growers: (1) The rind of the watermelon is tapped with the fingernail; if ripe, it will give forth a dull thud peculiar to that stage of growth; the proper sound can be determined only after personally testing a large number of fruits. (2) The condition of the tendril attached to the vine near the melon stem is carefully examined; if this is dried up, it is an indication that the fruit is ripe. (3) Pressure may be applied to the side of the watermelon; if the flesh can be heard to crack when this is done, it is a good indication that the fruit is ripe; this practice is, however, not permissible with watermelons that have to be shipped long distances. The small grower who can examine his watermelons personally can always send his product to the market at a better stage of ripeness than the large grower who must depend on others for this work.

**91.** When watermelons are intended for long-distance shipment, they must be carefully handled so that they will not decay in transit. The fruit should be very carefully handled in the field, and should be hauled to the freight cars in spring wagons. To avoid any unnecessary hauling of watermelons, most large growers are located near a railroad track, so that a long haul in wagons is avoided. It is not uncommon to have a spur track run into a large watermelon field in parts of the South.

Further precautions to prevent bruising are necessary in packing a freight car with watermelons. The floor of the car should be bedded 1 or 2 feet deep with straw to take up much of the jar during the trip. The smaller watermelons should be packed on the bottom layer. This is because the smaller fruits will withstand pressure better than the large ones, and because, if injury occurs, only the cheaper stock will be damaged.

The watermelons are packed in the freight cars from four to six deep, usually not more than four deep, unless the watermelons are small. About 800 35-pound watermelons will fill a 34-foot freight car 4 feet deep, and about 1,500 17-pound watermelons will make a carload when piled six deep.

92. Watermelons are sometimes sorted into three and sometimes in four grades; when four grades are made they are usually designated as *extra*, *large*, *medium*, and *small*. The watermelons are separated into the different grades on the basis of weight, although the weights are not all the same in different localities and in different seasons. The watermelons in the extra, or largest, grade may be required to weigh 60, 70, or 80 pounds, as the case may be; sometimes this grade will include many that weigh more than 100 pounds. Those in the small grade are almost uniformly required to weigh more than 16 pounds. The weights of those of the large and medium grades are intermediate between those of the others.

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#### MARKETING

93. The prices of watermelons vary widely because of great variations in the supply arriving in the markets on different days. In the large markets, where many of the watermelons arrive in a fully ripened and more or less bruised condition after several days on the rail, watermelons are considered a rather perishable product and are usually sold immediately for whatever price they will bring. On days when the larger markets are glutted, large quantities of watermelons may be dumped overboard to get rid of them; this is due to imperfect methods of distribution.

In the New York wholesale markets, watermelons are commonly sold by the hundred, the price being based on the size, quality, and condition. The earliest watermelons, that is, those received in May, are commonly sold by the single fruit.

Watermelons are a short-season market crop. They are found in the New York and other large markets from May to September, inclusive. The highest prices are received for the

first watermelons, when from 25 cents to \$1.50 is paid for single specimens. After May, the price steadily declines throughout the season. In the New York wholesale markets the extreme prices after May are from about \$3 to \$75 a hundred; the low average price is about \$6, and the high average price about \$53 a hundred.

Table II shows the monthly low and high extreme and average prices of watermelons in the New York wholesale markets for the 10 years from 1903 to 1912, inclusive. These prices are computed from the average of the low and high prices on the

**TABLE II**  
**PRICES OF WATERMELONS IN THE NEW YORK MARKETS**

Month	Per Hundred			
	Extreme Prices		Average Prices	
	Low	High	Low	High
May.....	*\$ .25	\$ 1.50	*\$ .66	\$ 1.03
June.....	15.00	75.00	25.00	53.33
July.....	10.00	60.00	14.50	40.00
August.....	5.00	40.00	9.88	25.25
September.....	3.00	28.00	6.00	19.40

\*Each.

first and fifteenth of each month for the 10 years mentioned. They clearly indicate that the largest gross returns can be secured only from the watermelons sent to market early.

In many local markets, watermelons will retail in small quantities at from 10 cents to 75 cents each.

Growers who ship large quantities of watermelons long distances in carload lots usually sell them at so much a car or at so much a hundred, the price varying with the grade, and the supply.

## CITRONS

**94.** The term **citron** is applied to two widely different forms of plants and their fruit. The citron considered here is a small, hard-fleshed kind of watermelon, the flesh of which is used for preserves. The true citron of commerce belongs to the citrus family and grows on trees and is cultivated to some extent in Florida and California; it is a large, thick-rinded, lemon-like fruit, and the rind is used in the manufacture of



FIG. 13

preserves and confections. It is because of the fact that they are used for the same purpose that the name citron is applied to both of these products, which differ so widely both botanically and culturally.

**95.** The citron that is similar to the watermelon has a smaller and less vigorous-growing vine than the watermelon, but the foliage and vine characteristics are similar to those of the watermelon. The fruit grows to a size of 6 to 8 inches in diameter, is hard, round, and never becomes soft, as does the watermelon; a fruit is shown in Fig. 13. Citrons yield heavily and a few vines will supply all the fruit that the average grower can dispose of. Usually only one variety is offered for sale by the seed houses.

**96.** The seed is of the same general shape as that of watermelon, but is smaller and olive-green in color. Seed that is

saved from home-grown fruits will usually give good results. The seed retails from seed houses at from about 75 cents to \$1 a pound in pound lots.

**97.** Citron seed is planted at about the same time as muskmelon seed and in the same manner. The culture is also much the same, except that few growers pay as much attention to the crop as to the muskmelon crop.

**98.** The citron is rarely troubled by insect pests or fungous diseases, and practical growers rarely if ever make any effort to prevent loss from this cause, and the results would not often justify the expense.

**99.** There is usually a limited demand for citron in most localities during the pickling season in the fall. The quantity bought by any one consumer, however, is relatively small. The market price varies from 1 to 2 cents a pound.



# SWEET CORN

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## GENERAL REMARKS

1. **Sweet corn** is particularly well adapted to the climatic conditions of the United States, where it is an important truck, market-garden, and home-garden crop. It is not grown to any extent in European countries, principally because the growing season there is not well adapted to it. The plant is of American origin and has been developed from maize, or common field corn. Fresh sweet corn can be found in the markets from May until the latter part of October, or until cold weather sets in in the fall, and canned sweet corn is available at all seasons of the year.

2. When grown as a vegetable crop, the immature kernels are the only parts used for human food. In this stage the grain is said to be *in the milk*, and the ears are known as *roasting ears*. Sweet corn is grown in large quantities for the canneries, and is one of the important vegetables in the canning trade, some millions of pounds being canned annually in the United States. This large quantity is used principally for domestic sale; little is exported. In addition to its use as human food, sweet corn is grown in large quantities in some dairy sections for silage, and in some market-gardening and truck-farming sections, the fodder is sold to dairymen for stock feeding.

3. Sweet corn as a vegetable sells well in the market. It is always in demand at some price, although, as discussed later, the prices vary considerably at different times of the year and even in the same months. Some growers favor this crop because it can be raised at a low cost per acre, and because it

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can be conveniently intercropped and harvested in time for a fall crop to occupy the land. The culture of sweet corn, however, is not commonly attractive to the market gardener whose area is limited, whose land is high in value, and who can produce the smaller vegetable crops with greater profit.

4. The sweet-corn plant is tender to frost, but some of the varieties require a comparatively short season for growth, and can often be planted to advantage on pieces of land for which there is not pressing use. Sweet corn will probably stand more abuse in the way of lack of care than almost any other garden vegetable and still yield a fair-sized crop.

5. **Commercial Importance.**—The sweet-corn crop is one of the most valuable of the vegetable crops in the United States. In 1909, the total value of the crop was about \$5,936,419; this was raised on 178,224 acres, distributed over 48,514 farms. It is about 43 per cent. as large as the tomato crop, and about 71 per cent. as large as the cabbage crop.

Sweet corn is grown to a greater or less extent in every state in the United States. The eleven most important states, ranking in the order of the quantity produced, are: New York, Illinois, New Jersey, Ohio, Pennsylvania, Maryland, Massachusetts, Maine, Iowa, Indiana, and California; in 1909, the lowest of these states produced a crop of a value of more than \$180,000. The first ten of these states produced about 76 per cent. of the total crop; New York produced about 15 per cent., and Illinois, New Jersey, Ohio, and Pennsylvania, each produced from 8 to 9 per cent.

6. The average income per acre from sweet corn for the United States is about \$33, and the average acreage per farm is about 3.68; in some states the average acreage per farm is more than 6. The average incomes per acre for the principal states are: California, \$65; New Jersey, \$53; Pennsylvania, \$43; New York, \$40; Maine, \$31; Ohio, \$30; Illinois, \$28; Indiana, \$23; Maryland, \$21; and Iowa, \$17.

7. The canning of sweet corn is now a large and important industry in the United States. In 1909, 7,451,265 cases of sweet

corn valued at \$10,332,136 were packed; in 1904, 11,209,597 cases valued at \$15,952,386; and in 1899, 6,336,984 cases valued at \$8,191,383. The canning of sweet corn fluctuates from year to year because of weather conditions, and has not shown as steady a growth as the tomato-canning industry and as some of the other canning industries.

**8. Cost of Production and Returns.**—As is the case with all vegetable crops, the gross returns per acre from sweet corn will depend on the season, soil, fertilization, cultivation, market, and the salesmanship of the grower. When grown as a market garden crop, about \$60 to \$70 will be required to pay the expenses of production, and at the average prices, discussed later, the income per acre for skilful growers should be between \$150 and \$200. In some exceptional cases returns as high as \$350 per acre have been secured. A gross income of \$100 per acre is usually considered necessary to make a satisfactory profit. This is based on the assumption that 1 acre will produce 10,000 ears, and that they can be sold for at least \$1 per hundred. When \$3 or \$4 a hundred can be secured, the gross returns will obviously be much larger. When grown with companion crops, the gross income and profit from the land on which sweet corn is grown may be made somewhat greater.

**9. Soils for Sweet Corn.**—Sweet corn succeeds best on a light loam that is well manured, but it will produce a good crop on any soil on which field corn will do well, such, for example, as the medium heavy loams. Sweet corn thrives well on sod land, but the crop may suffer from the insect enemies of grass. This is explained later.

## VARIETIES AND SEED

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### VARIETIES

10. More than one hundred varieties of sweet corn are now on the market, and most of these have been introduced since the middle of the 19th century. On account of the constant demand for earlier and more hardy kinds, the number of varieties is constantly increasing, and frequently new varieties said to possess these desirable characteristics to an extreme are placed on the market. All varieties of sweet corn have been developed more or less directly from different varieties of field corn.

11. The *Cory*, or *White Cob Cory*, sweet corn, shown in Fig. 1, is an early variety and is considered by many to be the standard early variety. The plants are productive, hardy, quick-maturing, and the stalks and ear are small. The cob

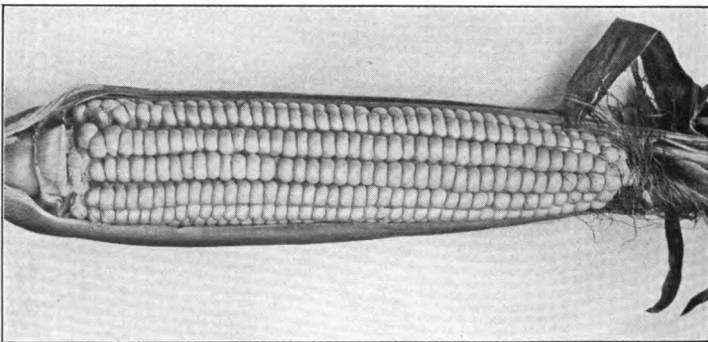


FIG. 1

grows to a length of about 8 inches and has eight rows of kernels. The quality is only fair, but, on account of being ready for the market so early, this variety always meets with a ready sale. Many strains of *Cory* are on the market, and the selection of a good strain is essential to the production of a successful

crop, because the strains vary widely in the size of the cob, quality of the kernels, and the earliness of ripening. The Cory variety may be closely planted, because its stalks rarely grow to a height of more than 4 feet; and, on account of the early-maturing habit of the plant, all the ears should be picked and the land cleared of stalks by August 1 in the latitude of New York City.

**12.** The **Crosby** sweet corn is considered a standard second-early variety. Many strains of this variety also are on the market; the best are superior to the Cory in quality and are more productive, although the ears mature about 10 days later than those of the Cory. The Crosby has twelve rows of kernels on the cob, and the stalk grows from 15 to 20 inches taller than those of the Cory.

**13.** The **Golden Bantam** sweet corn, shown in Fig. 2, is now generally conceded to have the highest quality of any of the better-known varieties of sweet corn. For this reason it is particularly desirable for the home garden. The ears are small, the crop does not mature as early as that of some of the other varieties, and the pale, creamy yellow color of the kernels on the marketable ears is sometimes considered a disadvantage from a commercial point of view. When sold

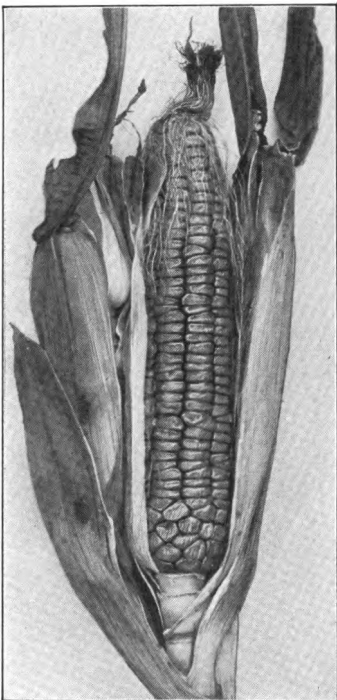


FIG. 2

in a local market, however, the ears sell at a premium shortly after they have been introduced. Golden Bantam can be sown in successive plantings and will do well at all times of the season.

**14.** The **Quincy Market** sweet corn is a popular midseason variety for spring similar to the Crosby. Other good midseason

varieties are the **Cosmopolitan**, **Howling Mob**, and **Sweet Orange**. Some consider the latter equal to the Golden Bantam.

**15. Potter's Excelsior**, the **Country Gentleman**, and **Stowell's Evergreen** are popular late varieties of sweet corn.



FIG. 3

The **Country Gentleman**, shown in Fig. 3, and **Stowell's Evergreen**, shown in Fig. 4, are largely raised for the canning

factories. The Country Gentleman is commonly considered to be the best variety for canning and will usually bring about 20 or 25 per cent. more for this purpose than any other. Stowell's Evergreen, however, usually counterbalances this disadvantage to some extent by giving a somewhat larger yield per acre. These varieties produce stalks from 6 to 8 feet high that bear from one to two ears of fine, large sweet corn. On account of the long season required to mature a crop, however, these varieties are not often grown by the market gardener. The ear of Stowell's Evergreen shown in Fig. 4 was grown in New York State.

**16. The Golden Dawn and Honey Sweet** are late varieties of yellow sweet corn; they are of good quality, but are not extensively planted because they require more time to mature than the Golden Bantam. They are, however, liked by many persons who prefer a larger ear than that borne by the Golden Bantam. There is a steadily increasing demand in all localities for large yellow ears of sweet corn of high quality.

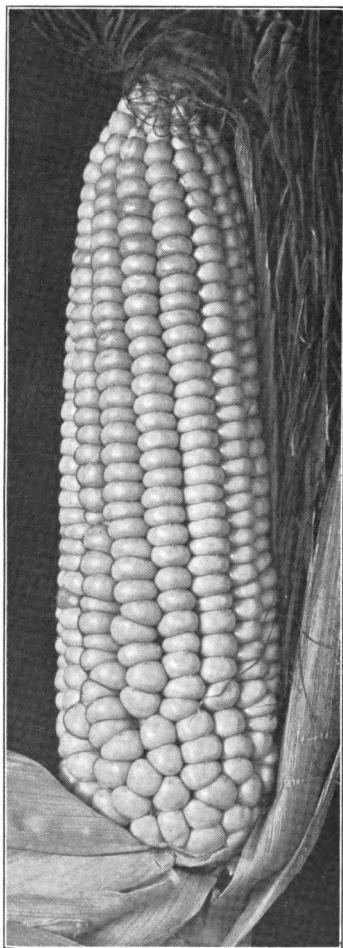


FIG. 4

**17.** The selection of varieties of sweet corn for growing in any particular locality depends largely on what is most in demand in the market. Almost any of the white varieties previously described will sell well in any market. In the

markets where the high quality of the yellow varieties, notably Golden Bantam, is known and appreciated, however, the best returns can be secured from the yellow sweet corn. In most local markets where it is known, Golden Bantam ears will sell for from 2 to 4 cents more per dozen than the ears of the white varieties; as this variety is no more difficult to grow and will yield as well or better than the white varieties, many growers now give it the preference. Any attempt to supply a wholesale market with yellow sweet corn, however, should be made with caution, because many dealers do not appreciate its quality, and, where there is little demand for it, regard it as in the same class as field corn. The safest plan is not to send yellow sweet corn to a wholesale market unless there is a specific demand for it; a few commission men in almost all big markets will have a brisk sale for it, but some difficulty may be experienced in finding these men. The extra pains taken to ascertain the demand before shipping yellow corn to a large market will be an insurance against financial loss. Sweet corn is too perishable to ship where it will not be quickly sold.

18. The varieties which should be planted depend on the conditions under which the crop is to be grown and marketed. Most market gardeners prefer to plant only two or at most three varieties, and some make successive plantings of only one variety. However, a market gardener usually finds it essential to plant one of the earliest varieties of sweet corn in order to get into the market early, but to make successive plantings of the earliest varieties is usually not advisable, because the quality of the earliest kinds is not good enough to compete with the better later varieties. The second variety planted should be one that produces ears of a good size and of good quality and one that thrives particularly well in the locality. Corn of such a variety will readily displace that of earlier varieties of poorer quality. To yield profitable returns, this second-early variety must be of good enough quality to suit the trade to which it is sold and to hold its place in the market. When one such variety is found, the best practice is to use it for all the plantings after the extra-early instead of

using two or three different varieties, because successions can be more readily planned, and the variety will become a standard in the neighborhood; that is, the trade will soon come to know the variety and its quality. In such circumstances, a variety like the Golden Bantam has produced exceptionally good results.

**19.** The truck grower who produces sweet corn needs to pay less attention to edible quality than to good shipping qualities and attractive appearance; in addition to this, of course, the corn must be well packed or it will heat and the husks will turn yellow and injure the appearance; corn with attractive green husks always sells for the best prices. The husks of the varieties of corn of the best quality seem to lose their green color more readily than some of the coarser varieties, and are thus not suitable for the trucker.

**20.** The grower who produces sweet corn for the canning factory is in an entirely different class than the market gardener and the truck farmer. Usually, the seed is supplied to him by the factory manager, and he seldom has any choice in the selection of varieties. The plantings by growers for the canning factories are usually extensive, the object being to secure not only a large yield of ears but also a good yield of fodder that can be fed to cattle. As the returns per acre from sweet corn grown for the cannery are small, the grower cannot afford to spend much money in producing it, and hence the crop for the cannery receives little care and attention as compared with the crops produced by the market gardener and truck farmer.

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#### SEED AND SEED PRODUCTION

**21.** The quality of sweet-corn seed is a very important matter for growers to consider. Almost all growers who produce sweet corn on a large scale set aside a certain portion of a field for the production of seed for the crop of the following year, because acclimatization plays such an important part in the success of this seed, and they are unwilling to take the chances of growing a crop from seed which they do not know

for a certainty to be acclimated to that section. Experiments at the Maryland Agricultural Experiment Station have clearly indicated that seed from northern localities does not produce as good results in the South as Southern-grown seed.

When corn is grown for the canning factory, the quality and character of the seed should have as careful consideration as

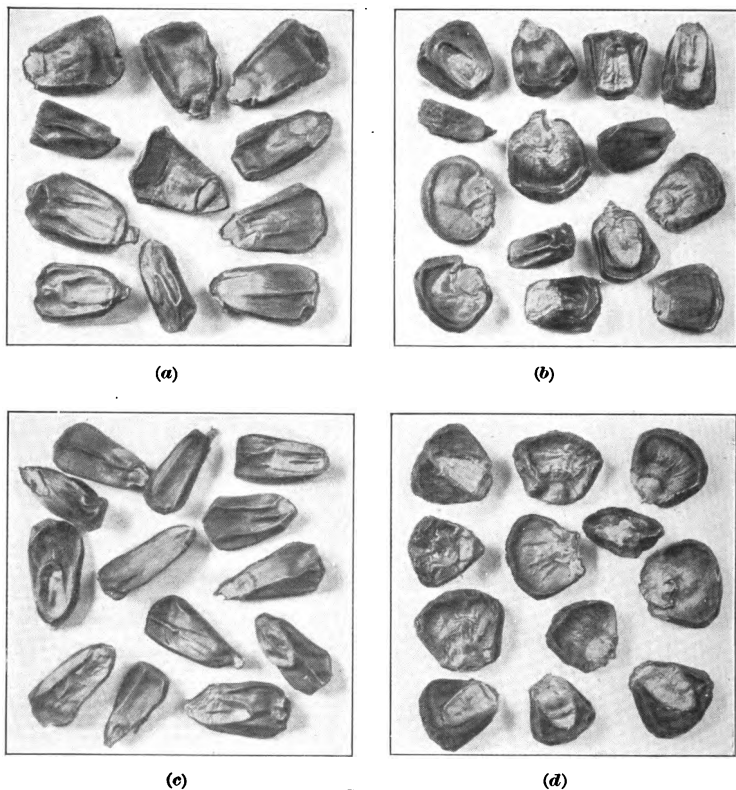


FIG. 5

when the crop is produced for market. Many farmers are unable to produce or procure seed that will produce corn of the required kind. As most canning factories require large quantities of corn of the same kind, so that their pack will be uniform, they supply the seed from which the crops for their purposes are to

be grown. This practice insures not only more uniform but also usually more abundant crops than would otherwise be possible.

**22.** Sweet-corn seed is rather large, about 115 to 150 being required to weigh 1 ounce; 1 quart will weigh about 22 to 24 ounces. Samples of sweet-corn seed are shown natural size in Fig. 5. In (a) are shown Stowell's Evergreen kernels; in (b), Howling Mob kernels; in (c), Country Gentleman kernels; and in (d), Golden Bantam kernels.

Sweet-corn seed is of medium longevity, the average length of satisfactory germination being about 2 years, and the extreme limit about 4 years. Most growers prefer to use seed not more than 1 year old. The seed usually germinates rather quickly,

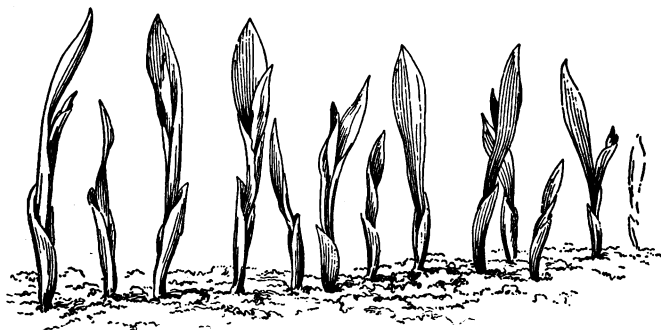


FIG. 6

from 3 to 12 days being required for the process. A few sweet-corn seedlings in the earlier stages of their growth are shown actual size in Fig. 6. To be considered of the best grade, sweet-corn seed should be 99 per cent. pure, and about 94 per cent. of the seed should germinate.

On an average, from 8 to 10 quarts of seed are required to sow 1 acre, and from 2 to 3 ounces are required to sow about 100 feet of drill. The seed usually retails from the seed houses for about \$2 a peck.

**23.** Sweet-corn seed can be produced successfully anywhere the crop grows well. In fact, the ability of the growers being the same, the seed that is produced in a locality will probably do better in that locality than elsewhere.

Sweet corn can be improved by selection as readily as any vegetable crop. The principal points to be considered in

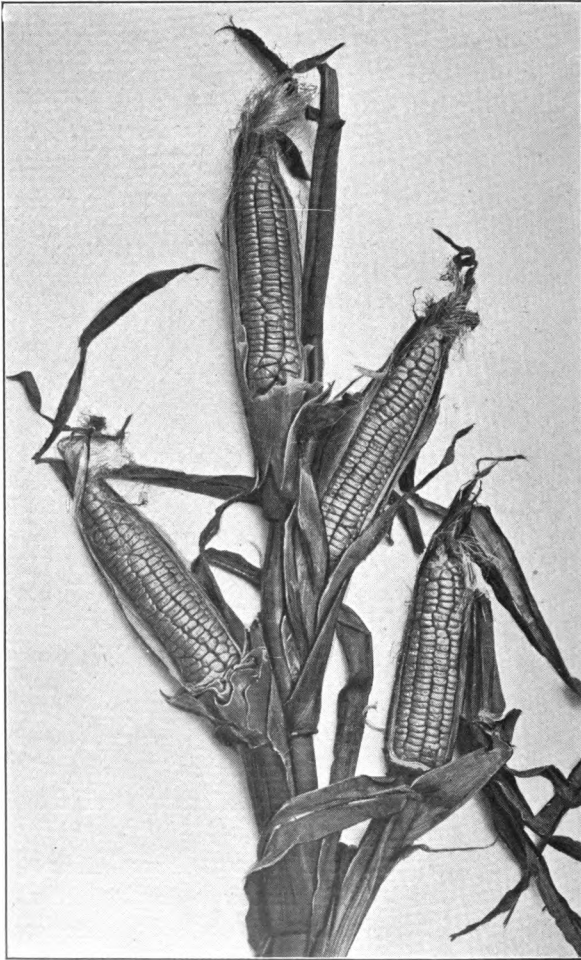


FIG. 7

breeding it are: (1) High yield; (2) early maturity; (3) production of ears of uniform size that are well filled with good-sized kernels; a desirable stalk bearing four fine ears is shown

in Fig. 7; (4) quality of the corn, which is coming to be more and more recognized as an important feature, especially in sweet corn that is to be sold to a local trade; and (5) selection of seed ears from plants that have few or no suckers. The tendency of sweet-corn plants to send up suckers is hereditary; care should be taken to avoid such plants, because the production of suckers detracts from the ability of a plant to produce marketable ears.

24. *Detasseling*, which is the removing of the tassels from some of the plants in a sweet-corn seed plot, is a regular part of sweet-corn seed breeding, and is necessary to prevent the crossing of undesirable plants. Both female and male flowers are borne on the same plant. The *silk* at the end of the cob is made up of strands that are the outer parts of the female, or pistillate, flowers; and the *tassels* at the top of the stalk are the male, or staminate, flowers. Although both kinds of flowers are borne on the same plant, the tassels, or male flowers, usually mature before the silk, or female, flowers of the same plant, although this will not hold true in every instance. This is a provision of nature to insure cross-pollination, which results in increased vigor in the offspring. The pollen of the male flowers of one plant are commonly blown by the wind on the silks of other plants and fertilization is thus accomplished. Detasseling is done on those plants which are undesirable, to prevent the spread of the pollen from them; this work should obviously be done before the pollen is ripe and ready to break out of the pollen sacks, and also before the silk begins to show on the ears. To insure good cross-pollination, some growers detassel every alternate row, and then detassel other undesirable plants in the rows where the tassels were not at first removed; there is an abundance of pollen in each tassel and a large proportion of them may be removed without danger of a shortage. The seed ears are then selected from only the best plants in the rows that were first detasseled. Few seed growers go to this trouble, however, merely confining their work to detasseling poor plants.

The selection should be carefully made, and tassels should be left only on stalks that show two or more good ears that develop

early. The type of the ear should be as nearly ideal as possible. If such a practice is systematically followed for a few seasons remarkable results may be secured. When sweet corn is grown for seed the ears are not picked when the kernels are in the milk stage, as when they are to be eaten, but the grains are allowed to mature and harden. The ears that are to be kept for seed should be carefully selected from among those on the best-appearing stalks, and only ears of the type pre-

viously described should be kept.

25. The ears that are selected for keeping should be stored in a dry, cool, well-ventilated room. The temperature and moisture conditions should be constant so the vitality of the seed will not be injured, and particular care should be taken to see that decay is never allowed to gain headway.

The method of storing seed corn is fully as important as any of the steps in

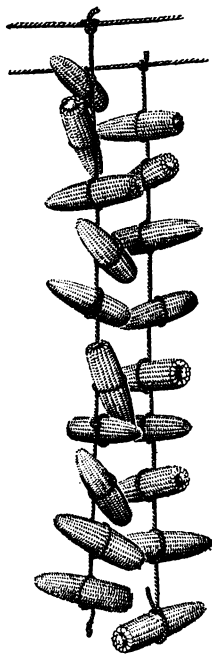


FIG. 8

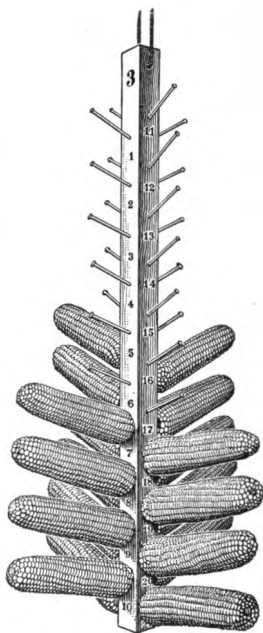


FIG. 9

the work of seed production. The air must have free circulation about each ear, and for this reason only specially devised racks are suitable when corn is to be stored on a large scale. On a small scale, the ears may be strung on pieces of binder twine, or string, as shown in Fig. 8, the strings being suspended from an overhead support.

26. When larger quantities of corn are to be dried and preserved, devices that are more economical of space and easier

to handle are necessary. A simple drying rack can be constructed by driving small-headed finishing nails in a piece of 2"×2" lumber, as shown in Fig. 9; the butts of the corncobs are stuck on the nails. The numbers marked on the rack may be used for preserving the identity of individual ears used in germination tests.

27. Probably one of the cheapest forms of corn-drying racks, and also one that can be stored in a small space when not in use and that will last almost indefinitely, is shown in the

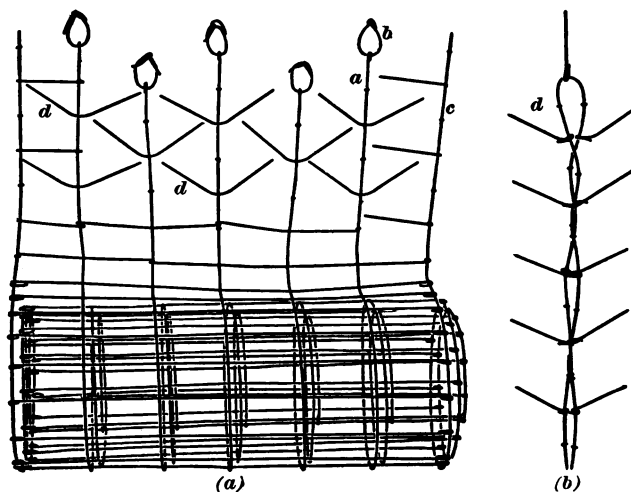


FIG. 10

process of construction in Fig. 10. This rack is made from galvanized, electrically-welded wire fencing; the cost of a rack of this kind sufficiently large to store 1 bushel of seed should not exceed 10 cents. The racks may be most economically made by cutting the wire fencing as shown in (a). The racks *a* are made by cutting off each of the crosspieces *d* alternately close to the adjacent wires; the rings *b* are made by twisting together the ends of the two top severed crosspieces, and are used for hanging up the rack. Each of the two side pieces *c* are made into racks by doubling them on themselves in convenient lengths as shown in (b), and then twisted as illustrated, so that the

sections of the crosspieces *d* come opposite each other. The segments of the crosspieces *d* are bent slightly upwards, so that the ears will not slip off.

28. When seed sweet corn is raised annually in large quantities, permanent drying racks like that shown in Fig. 11

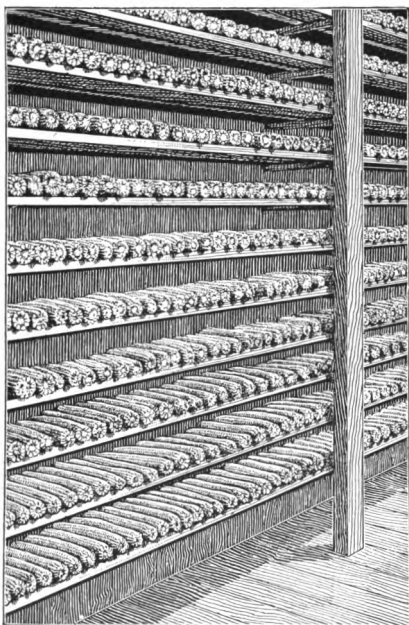


FIG. 11

are usually advisable. Sweet corn will keep well in such racks if the room is well ventilated.

29. In drying houses where rodents are likely to be found, seed corn should be stored in wire crates similar to that shown in Fig. 12. The reason is obvious.

30. If signs of weevils or of grain moths are noticed on corn before it is put in storage, the ears should be fumigated thoroughly with carbon bisulphide gas. To do this the ears should be placed in practically airtight bins, rooms, or boxes and exposed to the fumes of

the chemical for 48 hours. The carbon bisulphide should be placed in shallow pans on top of the corn, either at the top of the room or bin or on top of the corn in a box, because the fumes are heavier than air and will settle to the bottom of the enclosure. In a small bin or box having a cubic capacity of 10 bushels or less, about  $\frac{1}{2}$  pint of carbon bisulphide will be sufficient. For larger enclosures the quantity should be figured accordingly. Carbon bisulphide is inflammable and for this reason no fire should be allowed near it and the bin or room in which the fumigation is done should be well aired before the corn is removed.

**31.** In some cases it is desirable to store the seed ears in practically air-tight boxes with some insect-repellent material, in order to prevent the ravages of moths, etc. during the winter.

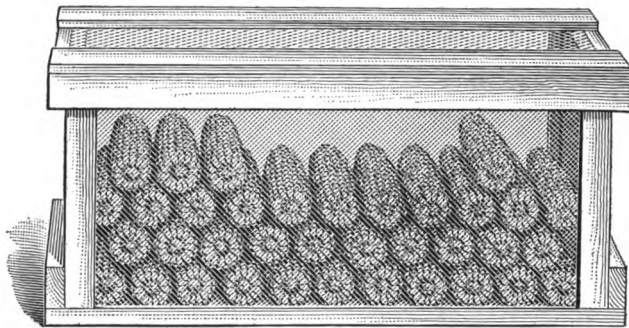


FIG. 12

Under such circumstances about 1 pound of moth balls or naphthalene should be placed with each bushel of corn; the cost will be trifling, and this quantity of either moth balls or naphthalene will not injure the seed.

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## PLANTING AND GENERAL MANAGEMENT

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### PLANTING

**32. Time for Planting.**—The time for planting sweet corn is a very important factor. The market gardener and truck farmer commonly plant sweet corn as early as possible so as to get an extra early crop, because the first-early sweet corn will usually bring from 30 to 50 per cent. more than the second-early; as soon as the great bulk of the sweet-corn crop is dumped on the market the prices slump accordingly. Growers who produce sweet corn for the canning factories do not lay so much stress on early planting, except in some of the Northern districts, as Maine, where the growing season is so short that unless the seed is planted as soon in the spring as the weather permits it will not have time to mature before frosts in the fall.

**TABLE I**  
**DATES OF LATE SPRING AND EARLY AUTUMN FROSTS**

Station	Date of Latest Recorded Killing Frost in Spring	Date of Earliest Recorded Killing Frost in Autumn	Average Date of Last Killing Frost in Spring	Average Date of First Killing Frost in Autumn
Alabama:				
Mobile.....	Mar. 28	Oct. 31	Feb. 24	Nov. 30
Montgomery.....	Apr. 5	Oct. 21	Mar. 11	Nov. 8
Arizona:				
Phoenix.....	Mar. 31	Nov. 9	Feb. 18	Dec. 7
Yuma.....	None	None	None	None
Arkansas:				
Fort Smith.....	Apr. 6	Oct. 15	Mar. 4	Nov. 4
Little Rock.....	Apr. 14	Oct. 22	Mar. 20	Nov. 10
California:				
Eureka.....	May 1	Nov. 7	Apr. 2	Dec. 8
Fresno.....	Apr. 14	Nov. 18	Mar. 4	Dec. 15
Los Angeles.....	Apr. 8	None	Apr. 8	None
Red Bluff.....	Apr. 25	Nov. 15	Feb. 26	Dec. 6
Sacramento.....	Apr. 26	Oct. 28	Feb. 16	Nov. 15
San Diego.....	None	None	None	None
San Francisco.....	Apr. 20	Nov. 18	Jan. 8	Dec. 26
San Luis Obispo....	Apr. 8	Nov. 19	Feb. 20	Dec. 27
Colorado:				
Denver.....	June 6	Sept. 12	May 6	Oct. 5
Grand Junction.....	May 15	Sept. 27	Apr. 14	Oct. 21
Pueblo.....	May 23	Sept. 12	Apr. 26	Oct. 5
Connecticut:				
New Haven.....	May 30	Sept. 15	Apr. 20	Oct. 17
District of Columbia:				
Washington.....	May 11	Oct. 2	Apr. 7	Oct. 21
Florida:				
Jacksonville.....	Apr. 6	Nov. 12	Feb. 14	Dec. 6
Jupiter.....	Apr. 7	Nov. 18	Feb. 14	Dec. 29
Pensacola.....	Apr. 6	Nov. 12	Feb. 23	Dec. 5
Tampa.....	Mar. 19	Nov. 28	Feb. 8	Jan. 9

TABLE I—(Continued)

Station	Date of Latest Recorded Killing Frost in Spring	Date of Earliest Recorded Killing Frost in Autumn	Average Date of Last Killing Frost in Spring	Average Date of First Killing Frost in Autumn
Georgia:				
Atlanta.....	Apr. 15	Oct. 11	Mar. 24	Nov. 7
Augusta.....	Apr. 17	Oct. 8	Mar. 20	Nov. 9
Macon.....	Apr. 18	Nov. 5	Mar. 15	Nov. 14
Savannah.....	Apr. 5	Nov. 1	Feb. 27	Nov. 26
Illinois:				
Cairo.....	Apr. 19	Sept. 30	Mar. 29	Oct. 28
Chicago.....	May 29	Sept. 18	Apr. 18	Oct. 15
Springfield.....	May 22	Sept. 25	Apr. 20	Oct. 16
Indiana:				
Evansville.....	Apr. 21	Sept. 30	Apr. 10	Oct. 30
Indianapolis.....	May 21	Sept. 21	Apr. 16	Oct. 19
Iowa:				
Davenport.....	May 22	Sept. 18	Apr. 22	Oct. 14
Des Moines.....	May 22	Sept. 12	Apr. 28	Oct. 8
Dubuque.....	May 21	Sept. 27	Apr. 20	Oct. 13
Keokuk.....	May 4	Sept. 18	Apr. 13	Oct. 15
Sioux City.....	May 21	Sept. 13	May 1	Sept. 27
Kansas:				
Concordia.....	May 19	Sept. 27	Apr. 24	Oct. 14
Dodge.....	May 27	Sept. 23	Apr. 17	Oct. 15
Topeka.....	May 19	Sept. 28	Apr. 8	Oct. 13
Wichita.....	May 15	Sept. 23	Apr. 6	Oct. 19
Kentucky:				
Lexington.....	May 20	Sept. 30	Apr. 18	Oct. 23
Louisville.....	May 14	Sept. 24	Apr. 6	Oct. 29
Louisiana:				
New Orleans.....	Mar. 27	Nov. 19	Jan. 24	Dec. 15
Shreveport.....	Apr. 2	Oct. 20	Mar. 4	Nov. 11
Maine:				
Eastport.....	June 19	Sept. 8	Apr. 28	Oct. 12
Portland.....	May 31	Sept. 11	Apr. 14	Oct. 18

TABLE I—(Continued)

Station	Date of Latest Recorded Killing Frost in Spring	Date of Earliest Recorded Killing Frost in Autumn	Average Date of Last Killing Frost in Spring	Average Date of First Killing Frost in Autumn
Maryland:				
Baltimore.....	May 3	Oct. 6	Apr. 4	Nov. 4
Massachusetts:				
Boston.....	May 11	Sept. 30	Apr. 26	Oct. 22
Nantucket.....	Apr. 24	Oct. 1	Apr. 10	Nov. 5
Michigan:				
Alpena.....	June 9	Sept. 6	May 14	Sept. 26
Detroit.....	May 31	Sept. 21	Apr. 30	Oct. 11
Escanaba.....	June 16	Sept. 9	May 14	Oct. 1
Grand Haven.....	May 28	Sept. 23	Apr. 28	Oct. 10
Marquette.....	June 11	Aug. 22	May 15	Oct. 2
Port Huron.....	June 6	Sept. 22	May 8	Oct. 9
Sault Ste. Marie....	May 29	Sept. 5	May 16	Sept. 24
Minnesota:				
Duluth.....	June 8	Sept. 15	May 3	Oct. 5
Minneapolis.....	May 20	Sept. 13	Apr. 27	Oct. 8
Moorhead.....	June 8	Aug. 25	May 14	Sept. 22
St. Paul.....	May 25	Sept. 20	May 6	Oct. 5
Mississippi:				
Meridian.....	Apr. 10	Oct. 8	Mar. 20	Nov. 2
Vicksburg.....	Apr. 6	Oct. 19	Mar. 6	Nov. 12
Missouri:				
Columbia.....	May 9	Sept. 28	Apr. 14	Oct. 15
Hannibal.....	May 14	Sept. 30	Apr. 14	Oct. 15
Kansas City.....	May 4	Sept. 30	Apr. 10	Oct. 24
Springfield.....	May 19	Sept. 30	Apr. 16	Oct. 13
St. Louis.....	May 22	Sept. 30	Apr. 2	Oct. 27
Montana:				
Havre.....	June 6	Aug. 27	May 14	Sept. 13
Helena.....	June 9	Sept. 5	May 10	Sept. 25
Nebraska:				
Lincoln.....	May 10	Sept. 12	Apr. 18	Oct. 9
North Platte.....	May 23	Sept. 10	May 1	Sept. 28

TABLE I—(Continued)

Station	Date of Latest Recorded Killing Frost in Spring	Date of Earliest Recorded Killing Frost in Autumn	Average Date of Last Killing Frost in Spring	Average Date of First Killing Frost in Autumn
<i>Nebraska—Continued</i>				
Omaha.....	May 19	Sept. 18	Apr. 15	Oct. 12
Valentine.....	June 21	Sept. 12	May 9	Sept. 18
New Mexico:				
Santa Fe.....	May 18	Sept. 27	Apr. 15	Oct. 19
Nevada:				
Winnemucca.....	June 20	Aug. 22	May 15	Sept. 24
New Jersey:				
Atlantic City.....	Apr. 25	Oct. 1	Apr. 11	Nov. 4
New York:				
Albany.....	May 30	Sept. 23	Apr. 24	Oct. 17
Binghamton.....	May 21	Sept. 16	Apr. 27	Oct. 6
Buffalo.....	May 29	Sept. 23	Apr. 25	Oct. 16
New York.....	Apr. 30	Oct. 5	Apr. 10	Nov. 6
Oswego.....	May 29	Sept. 25	Apr. 27	Oct. 19
Rochester.....	May 30	Sept. 26	May 1	Oct. 19
North Carolina:				
Charlotte.....	Apr. 26	Oct. 8	Apr. 1	Nov. 4
Hatteras.....	Apr. 19	Nov. 7	Feb. 28	Dec. 11
Raleigh.....	May 6	Oct. 8	Apr. 5	Nov. 4
Wilmington.....	May 1	Oct. 16	Mar. 27	Nov. 15
North Dakota:				
Bismarck.....	June 7	Aug. 23	May 15	Sept. 21
Williston.....	June 10	Aug. 18	May 18	Sept. 14
Ohio:				
Cincinnati.....	Apr. 24	Sept. 30	Apr. 14	Oct. 25
Cleveland.....	May 22	Oct. 2	Apr. 16	Oct. 31
Columbus.....	May 17	Sept. 21	Apr. 16	Oct. 16
Sandusky.....	May 17	Oct. 8	Apr. 14	Oct. 26
Toledo.....	May 29	Sept. 9	Apr. 24	Oct. 15
Oklahoma:				
Oklahoma.....	Apr. 30	Oct. 7	Apr. 2	Oct. 31

TABLE I—(Continued)

Station	Date of Latest Recorded Killing Frost in Spring	Date of Earliest Recorded Killing Frost in Autumn	Average Date of Last Killing Frost in Spring	Average Date of First Killing Frost in Autumn
Oregon:				
Baker City.....	June 24	Sept. 4	May 25	Sept. 27
Portland.....	May 9	Oct. 13	Mar. 17	Nov. 16
Roseburg.....	May 16	Sept. 25	Apr. 15	Oct. 30
Pennsylvania:				
Erie.....	May 17	Oct. 12	Apr. 22	Oct. 29
Harrisburg.....	Apr. 26	Oct. 3	Apr. 10	Oct. 24
Philadelphia.....	Apr. 29	Oct. 3	Apr. 8	Oct. 30
Pittsburg.....	May 29	Sept. 25	Apr. 26	Oct. 19
Rhode Island:				
Block Island.....	May 11	Oct. 30	Apr. 12	Nov. 16
Narragansett.....	May 30	Sept. 21	Apr. 23	Oct. 16
South Carolina:				
Charleston.....	Apr. 2	Nov. 9	Mar. 1	Nov. 30
Columbia.....	Apr. 17	Oct. 19	Mar. 23	Nov. 8
South Dakota:				
Huron.....	June 8	Aug. 23	May 13	Sept. 20
Pierre.....	May 19	Sept. 12	Apr. 30	Sept. 30
Rapid City.....	May 21	Sept. 13	May 1	Sept. 20
Tennessee:				
Chattanooga.....	May 14	Sept. 30	Apr. 2	Oct. 26
Memphis.....	Apr. 16	Oct. 2	Mar. 24	Oct. 28
Nashville.....	May 14	Oct. 8	Apr. 2	Oct. 24
Knoxville.....	Apr. 24	Oct. 1	Apr. 3	Oct. 27
Texas:				
Abilene.....	Apr. 16	Oct. 24	Mar. 15	Nov. 15
Amarillo.....	May 23	Oct. 16	Apr. 16	Nov. 1
Corpus Christi.....	Mar. 19	Nov. 30	Feb. 27	Dec. 25
El Paso.....	Apr. 22	Oct. 23	Mar. 20	Nov. 10
Fort Worth.....	May 1	Oct. 22	Mar. 18	Nov. 19
Galveston.....	Mar. 1	Dec. 4	Feb. 5	Dec. 25
Palestine.....	May 30	Oct. 20	Mar. 13	Nov. 13
San Antonio.....	Mar. 20	Nov. 9	Feb. 25	Nov. 30

TABLE I—(Continued)

Station	Date of Latest Recorded Killing Frost in Spring	Date of Earliest Recorded Killing Frost in Autumn	Average Date of Last Killing Frost in Spring	Average Date of First Killing Frost in Autumn
Utah:				
Salt Lake City.....	June 18	Sept. 22	Apr. 23	Oct. 18
Vermont:				
Northfield.....	June 7	Aug. 27	May 13	Sept. 16
Virginia:				
Lynchburg.....	May 7	Oct. 4	Apr. 14	Nov. 1
Norfolk.....	Apr. 26	Oct. 15	Mar. 27	Nov. 12
Wytheville.....	May 26	Sept. 14	Apr. 23	Oct. 7
Washington:				
Seattle.....	May 27	Oct. 18	Mar. 21	Nov. 22
Spokane.....	June 8	Sept. 7	Mar. 23	Oct. 17
Tatoosh Island.....	Apr. 19	Nov. 1	Mar. 14	Dec. 15
Walla Walla.....	May 12	Sept. 28	Apr. 4	Nov. 7
West Virginia:				
Elkins.....	May 24	Sept. 28	May 18	Oct. 10
Parkersburg.....	May 22	Sept. 24	Apr. 11	Oct. 17
Wisconsin:				
Green Bay.....	May 30	Sept. 16	May 5	Oct. 4
La Crosse.....	June 1	Sept. 21	May 2	Oct. 8
Madison.....	May 13	Sept. 29	Apr. 21	Oct. 17
Milwaukee.....	May 29	Sept. 25	Apr. 29	Oct. 10
Wyoming:				
Cheyenne.....	June 11	Aug. 29	May 22	Sept. 16
Lander.....	June 18	Aug. 23	May 19	Sept. 11

Because of the short growing season, many growers find it best to plant early and take some chances with injury from spring frosts rather than to risk loss from fall frosts if they plant late. If the first planting is destroyed by a spring frost, a second planting may be made, or, if the time is too late, the land may be devoted to some other crop.

Market gardeners commonly plant sweet corn before all danger from frost is past because of the extra profit they can secure should the crop escape injury. Table I, which is taken from the United States Weather Bureau reports, shows the date of the latest recorded killing frost in spring, the date of the earliest recorded killing frost in autumn, the average date of the occurrence of the last killing frost in the spring, and the average date of the occurrence of the first killing frost in autumn at various points in the different states in the United States. The information contained in this table is useful in connection with the planting of other vegetables as well as sweet corn.

In some cases, successive plantings of sweet corn are made on the same field, in the hope that at least one will escape damage. Three plantings are made, the earliest of which should stand about 9 inches high, the second about 4 to 5 inches high, and the third should be just breaking through the ground about the time when all danger from spring frosts is over. As soon as the danger from frost is over, two of the plantings are removed, the oldest one that is uninjured by the frost being left to mature a crop.

**33. Preparation of Soil.**—Soil should be well plowed and harrowed for sweet corn. The pains taken to get it into good tilth will be well repaid. When the production of an early crop is to be attempted in northern localities, the land should always be plowed in the fall, because, if the plowing is deferred until spring, inclement weather may seriously delay the planting. The land is left rough throughout the winter, and a disk harrow is used in the spring to lighten it up. Many growers disk-harrow the ground twice and then go over it two or three times with a spring-tooth or a spike-tooth harrow.

When sod land is to be planted to sweet corn it should always be plowed in the fall, so that the sod will be at least partly

rotted in the spring. A sod turned under in the spring will usually make the soil too dry for the best results with sweet corn.

**34. Details of Planting.**—The distances for planting sweet corn vary with the variety, the value of the land, and the method of cultivation employed. The early varieties can be planted much closer than the later varieties. On expensive land the temptation is to plant the corn as closely as possible; it can be planted closer when considerable hand hoeing or wheel

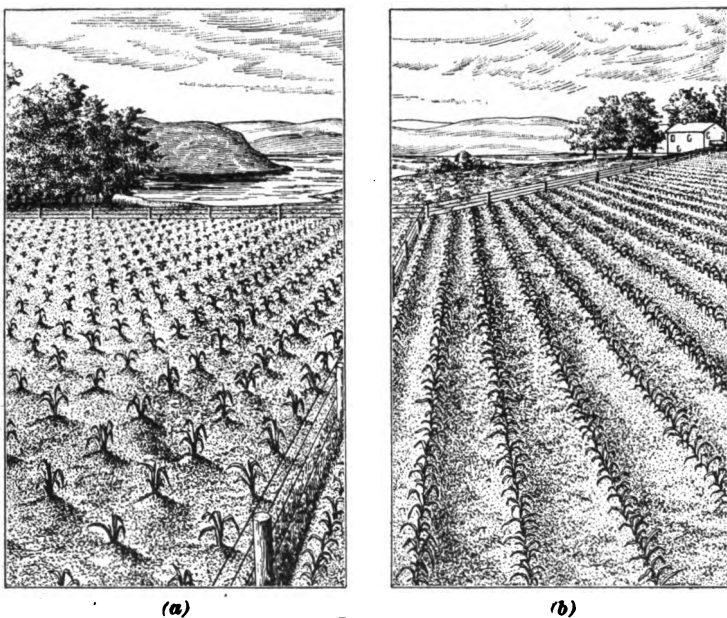


FIG. 13

hoeing is to be practiced than when all the work is to be done by horse-drawn implements. The distances for planting can be varied almost indefinitely, as long as the rows are kept far enough apart to permit of the most economical cultivation and to allow for the full development of each plant.

**35.** Sweet corn is planted, both in hills, as shown in the field in Fig. 13 (a); and in drills, as shown in (b); drills are more commonly preferred.

The rows for sweet corn planted in drills can be varied from 2 to 4 feet apart, although they are seldom planted less than  $2\frac{1}{2}$  feet apart. The plants will do well if they are thinned to stand about 12 inches apart in the row, but some prefer to have them stand 15 inches apart and others about 18 inches apart. In



FIG. 14

some cases, two or three plants are allowed to stand together in hills 18 inches apart in the row, but this is seldom considered advisable. Each grower must determine by experiment just what distances of planting produce the best results on his soil and under his system of management. A good stand is essential to a high yield, however, and the best practice is to sow the seed thickly to insure a good stand and then to thin the plants after they come up if there is an excess. They

should be thinned to stand not less than 12 inches apart in the rows, and when planted in hills, to not more than four to a hill, and usually three in a hill will give a better production of ears.

**36.** When sweet corn is planted in hills, a practice that may be necessary on weedy ground, special care should be taken to see that the kernels are not dropped too close together. The roots at the base of a sweet corn plant at silking time are shown in Fig. 14; for their best development, the roots require about 1 cubic foot of space. The silking time is the critical time in the life of the plant and if the roots are cramped for

space at this time they will not be able to secure enough nourishment for the proper development of the ears. When sweet-corn seed is sown in hills with the ordinary check-row planter, or as commonly sown by hand, the plants are crowded in the hill like those shown in Fig. 15, and there is not sufficient room for the best root development; note the dwarfed condition of one of the stalks in this hill; this stalk produced nothing but a nubbin.



FIG. 15

To avoid crowding the plants in the hill, a system called *kernel-spaced* planting has been devised, in which the kernels are planted at the corners of a square, commonly a 5-inch square; stalks growing from seeds so planted are shown in Fig. 16. Sometimes one kernel is planted at each corner of the square, and sometimes two kernels are planted at each corner; when two are planted the plants are thinned to one at each corner after

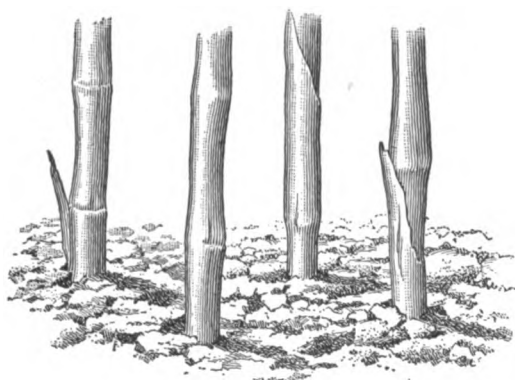


FIG. 16

they have attained a height of from 10 to 12 inches; this, however, requires more work than most growers can afford to give to sweet corn. In some cases, the kernels are planted at

the corners of a 6-inch or an 8-inch square; but planting them this far apart increases the difficulties of cultivation without a corresponding increase in the return.

37. A simple device for planting corn seed at the corners of a square is shown in Fig. 17; this is constructed by sinking four common wide-spouted tin funnels in a block of wood and attaching a stick for a handle. When corn is planted by hand, the work can be done rapidly with this implement. So far as

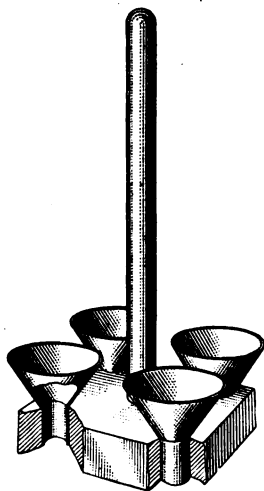


FIG. 17

known, no mechanical corn planter has been put on the market that will plant corn seed in this way.

38. For the early crop of corn, seed should be planted from  $\frac{1}{2}$  to 1 inch deep, but no deeper. Early in the spring the ground is cool, the moisture is abundant, and the conditions in the soil are such that the seed is very likely to rot if it is planted deep. If the seed is planted near the surface it will be in the warmest part of the soil, that is, in the part that will warm up quickest and where aeration is good. The seed will not suffer from a lack of moisture as early in the spring as May.

After the seed has germinated and the plants are up so that the side roots are unduly exposed, the soil can be thrown toward the row and a slight ridge formed to protect the roots. Deep planting early in the spring may result in a very poor stand. Later plantings may be somewhat deeper, but even in these some advantage is usually gained by shallow planting.

39. Sweet-corn seed can be planted in much the same way that field-corn seed is planted. Planting by hand, with a hand planter, with a seed drill, or with a one-row or a two-row horse planter is practiced. Hand planting consists merely in opening up holes by means of a hoe and dropping the seed in by hand. This is rather slow work, and the method is used only when a

small area is to be planted. Market gardeners use this method to some extent when planting sweet corn in hills. A shallow hole is scooped out with one movement of the hoe, the seed is dropped by hand, and is covered with an inch or so of earth with another movement of the hoe.

40. Faster work can be done with a hand corn planter than with a hoe. One form of hand planter is shown in Fig. 18. The seed sweet corn is placed in the can *a*, in the bottom of which is a notched disk, shown in (a), which is over a tube that conveys the seed as it is released to a point inside the jaws of the planter, slightly below the catch *b*, where it drops to the tips of the planter jaws; several disks with different-sized holes are supplied with the planter to permit of the planting of different numbers of seed in each hill. This disk in the bottom of the can *a* is operated by the catch *b* attached to the frame. Each time the upper part of the frame is opened by means of the handles, the catch turns the disk so that one of the holes comes over the mouth of the tube, or shoot, and a few kernels drop to the edges of the planter jaws. The tips of the jaws are then pressed an inch or more into the ground and the top of the frame is closed, thus opening the bottom sufficiently to allow the kernels to pass out into the ground. The planter is then removed and the operation repeated. In planting with such a machine, the field is usually marked with a row marker such as that shown in Fig. 19, so that the rows may be kept straight.

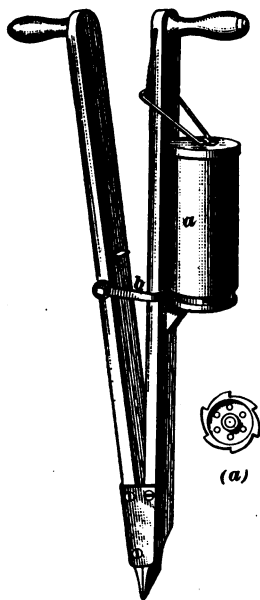


FIG. 18

41. An ordinary garden seed drill is frequently used for planting the early crop of sweet corn; such a machine will drop the seed in drills at any required distance and depth.

42. One form of one-horse single-row corn planter is shown in Fig. 20. The fertilizer, when it is applied at planting time,

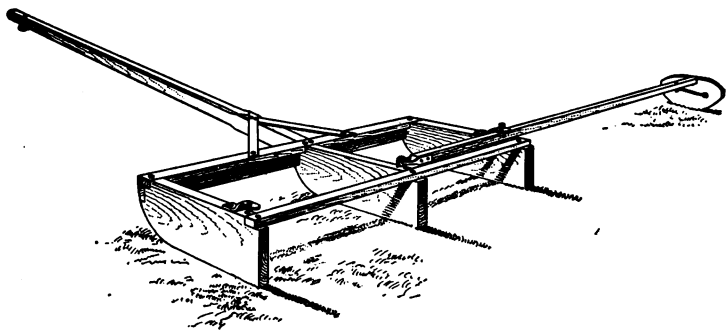


FIG. 19

is put in the large can *a*, and the seed is put in the small can *b*.

As the planter is drawn along, a furrow is made by the furrow opener *c*, and the kernels are dropped in the furrow one at a

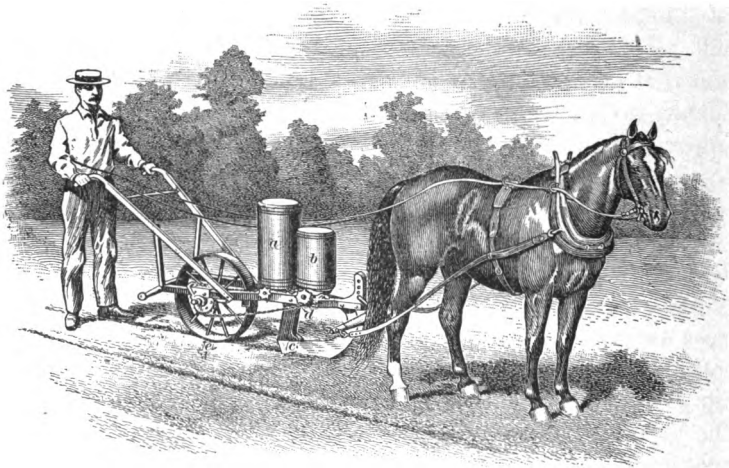


FIG. 20

time or in lots of three or four, as regulated by the chain attachment *d*. The wheel *e* closes the furrows and covers the seed.

43. A two-row corn planter operated by two horses is shown in Fig. 21. Machines of this kind are used for planting

field corn on an extensive scale and for sweet corn when it is grown for the canneries. The principle of operation of this machine is the same as for that shown in Fig. 20. The seed box is shown at *a*, the furrow opener at *b*, and the seed-covering wheel at *c*. No fertilizer cans are shown on this machine. Planters are made both with and without fertilizer attachments, whether or not they are on an implement depending largely on the section of the country in which they are offered for sale. The planter illustrated is set for dropping the kernels in hills. The seed-dropping part of this planter



FIG. 21

is regulated by a wire *d* stretched across the field. At regular intervals on this wire are knots that, as the planter is being drawn along the row, come in contact with a contrivance that causes three or four kernels to drop into the furrow at that spot. The wire is not used if the corn is to be planted in drills. This planter is equipped with a marker *e*, which is a disk on the end of the arm extending from the frame to the required distance; the marks made by the disk serve as a guide when the next row is planted.

44. In some sections of the United States, sweet corn is planted by a *lister*, which is a double plow that throws a

furrow both ways. This type of planter is intended primarily for the planting of field corn, but is also used in some cases for sweet corn.

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### GENERAL MANAGEMENT

**45. Cultivation.**—The cultivation of sweet corn should begin shortly after the seed has been planted, or as soon as any crust forms on the surface of the soil, as may be the case after a rain. Any crust that forms before the seedlings have a chance to come up will tend to reduce the stand, and for this reason it should be speedily broken up. A weeder is probably the best implement for this purpose. The weeder may be used for cultivating sweet corn until the plants are 10 or 12 inches high. Although a number of plants in a field may be rooted out or injured by this implement, the rest of the plants will be sufficiently benefited by its use to make up for any damage. The best time to use a weeder on sweet corn plants is between 10 A. M. and 3 P. M. on a hot day when the plants are somewhat wilted by the heat of the sun and are not as rigid and brittle as they are when the plant cells are filled with water at other times during the day.

The later cultivations of the crop may be given with two-horse and one-horse cultivators. The two-horse machines may be used to advantage until the corn becomes so high that it will be injured by the machine passing over it, and then the one-horse machines should be employed. Cultivation is usually considered to be the basis of success in the culture of sweet corn, and the ground should be stirred about once a week or even oftener if a rain causes a crust to form on the surface of the ground. Corn requires large quantities of water, and the conservation of moisture by cultivation is about the only way that enough moisture can ordinarily be secured to provide for the needs of a quick-maturing crop of sweet corn.

**46. Fertilization.**—Sweet corn requires plenty of humus and if this is not present in a soil and the crop is not being planted on an inverted sod, the application of stable manure is practically a necessity. Even when corn is to be planted

on a clover sod, the application of about 10 tons of good stable manure will produce profitable returns. Some gardeners apply as much as 20 tons per acre before planting corn. This will leave the soil in excellent condition for succeeding crops.

The quantities of commercial fertilizers applied to sweet corn vary in different sections from 200 or 300 pounds to 1,000 pounds, and sometimes even to 2,000 pounds per acre. Market gardeners who are striving to produce the earliest possible crop will sometimes apply as much as 1,500 to 2,000 pounds per acre, although the application of 1,000 pounds per acre is usually considered ample. The fertilizer formulas for different soils vary somewhat, but usually a fertilizer containing 4 or 5 per cent. of nitrogen, 7 to 9 per cent. of phosphoric acid, and 8 to 10 per cent. of potash will produce satisfactory results.

**47.** The commercial fertilizers are sometimes applied broadcast and then harrowed in before the sweet corn is planted. More often, however, especially when a corn planter is used for planting, part of the commercial fertilizer is applied in the drills by means of the fertilizer attachment on the planter. Usually, not more than 300 to 500 pounds of fertilizer are applied by a planter; if more is applied it is broadcasted before the seed is sown.

**48. Method of Securing an Extra-Early Crop.**—In some localities, especially where there is a local trade that is willing to pay fancy prices for the earliest vegetables, the growing of a crop of sweet corn that will ripen from a few days to 2 or 3 weeks ahead of a crop planted in the field may be a profitable practice. On account of the expense, this is not often done, and would not pay unless high prices of \$4 to \$6 a hundred, or more, can be assured for the crop.

To secure such an early crop, the plants must be started under glass in time for transplanting to the field about the same time that the seed is sown in the field. This would usually require that the seeds should be sown under glass about 3 weeks before the time of transplanting. One important point to consider is that the roots of the young corn seedlings must not be disturbed in transplanting, or they will not do well. This

necessitates planting the seed in pots; paper pots have been found to be most suitable for the purpose.

**49.** From six to eight kernels of corn are planted in a pot, which has previously been filled with rich earth or a good compost, and after the seedlings have come up the plants are thinned to the best three or four plants of the lot. When the plants have grown for about 3 weeks the pots are taken to the field, the paper torn from the bottom and the plants set in hills without disturbing the roots in any way. If the hills are spaced 3 ft. by 3 ft., about 4,840 pots of plants will be required to set an acre, and the extra expense for labor will be considerable. The transplanting in the open should not be done until after danger from frost is past, or the loss of plants may be heavy.

The starting of sweet-corn plants in this way does not necessarily require the use of a greenhouse or even of a hotbed, for the plants can be grown very satisfactorily in a cold frame. Perhaps on an average, sweet-corn plants started in a cold frame will stand transplanting in the field better than those started in a warmer atmosphere.

**50. Intercropping.**—Sweet corn may often be intercropped to advantage by the market gardener who is equipped to give the crops so closely planted the proper care and cultivation. In fact, many market gardeners can scarcely afford to grow a crop of sweet corn unless some form of intercropping is practiced. A method of intercropping sweet corn that is well adapted to localities in the latitude of New York City is as follows:

**51.** Early in the spring, about the first part of April, in the latitude of New York, a field is planted to spinach, the rows being spaced about 10 inches apart, and every fourth row across the field omitted. About April 25, or a little later, a row of an early variety of corn is planted in the blank rows. Prior to this planting the rows should preferably be cleaned out well by hoeing. These rows of corn should be hoed in the same manner as the spinach is hoed during the first few weeks of its growth, but this hoeing should be deeper than that given to the spinach and should be deep enough to keep the corn roots 2 or 3 inches

below the surface. By about May 25 the spinach may be cut and the ground between the rows of corn should then have a thorough and rather deep cultivation, but next to the rows the cultivation should be rather shallow so that the feeding roots of the corn will not be destroyed. At the next cultivation shovels should be put on the cultivator and a ridge 2 or 3 inches high thrown up against the rows of corn. This will give the supporting roots of the corn a better hold on the soil.

From this point on, frequent cultivation, as often as once a week, should be practiced until the silk is out on all the ears, which will probably be between July 1 and 10. If the cultivation has been well done, the surface of the ground should then be covered with a good dust mulch, and the soil beneath this should be moist.

**52.** In the latitude of New York, the first part of July is a good time for setting out celery plants, and many growers plant celery as the third crop on the land. If the weather is dry at this time, the ground should be well wetted before the celery is set; this can be best done from an overhead irrigation system. Celery may then be set halfway between the rows of sweet corn, and the shade furnished by the corn plants will benefit the young celery plants for the first 3 weeks of their growth in the field. The water applied to assist the celery will also do much to hasten and perfect the maturity of the sweet corn. After the celery is set, cultivation with hand tools must be practiced; and when the corn is being picked care must be taken to keep off of the celery, or much damage may be done.

**53.** The corn should be ready for market about July 25, and two pickings should be sufficient to harvest all of the marketable crop. It is rarely the case that the corn secured in the third picking will pay for the damage done to the celery. Immediately after the corn is picked the corn stalks should be removed, preferably by pulling them up by the roots. It is sometimes advisable to give the corn stalks to some local dairyman if he will agree to take them out promptly without injuring the crop of celery.

Many other combinations of crops may be worked out which will make it possible to raise at least one other crop besides corn, without in any way injuring either of the two crops.

**54. Suckering.**—On a corn plant the so-called suckers are the small shoots, or stalks, that grow out from the base of the plant; they almost never yield marketable ears, although they frequently develop useless small ears, or nubbins. When these suckers are allowed to develop they take a lot of nourishment from the roots and sap the vitality of the plant to such an extent that the yield of ears on the main stalk is impaired. By removing these suckers, the full strength of the plant is allowed to go into the main stalk, with the result that large ears of a uniform size are developed. Varieties of sweet corn vary in the number of suckers they throw up, and seasonal and soil conditions also have an influence on the suckering tendency of a corn plant. Hence, in some cases more labor will be required for removing suckers than in others.

Suckering is done by pulling off or breaking down the suckers when they reach a height of from 12 to 18 inches. The most rapid method of doing the work is to walk down between two rows of corn and break off all suckers that stick out into the space between the rows, thus really doing one-half of each of two adjacent rows at a time. The suckers on the other side of the row of corn are removed the next time across the field.

**55.** Whether or not suckering will be a profitable practice will depend largely on the cost of labor. As a general rule, suckering is considered to be advisable only on sweet corn that is planted for the first-early crop, and on varieties that have the suckering habit to an extreme. The appearance of sweet corn that is to be sold in the market as green corn can always be improved by breaking off the suckers, and for local markets where the appearance is of prime importance it may pay on all the crops of sweet corn. Suckering will always produce some beneficial effects, although the results may not always justify the expense. The value of suckering has been greatly exaggerated by some enthusiasts.

**INSECT PESTS AND INJURIES**

**56. Insect Pests.**—Sweet corn is subject to the attack of many insects, although few do serious damage when the land has been cultivated for a number of years. For most of these insects there is no successful preventive treatment other than to practice the proper cultural methods. Corn is a member of the grass family and the many insects that prey on the grasses, and more particularly on their roots, also attack corn when the

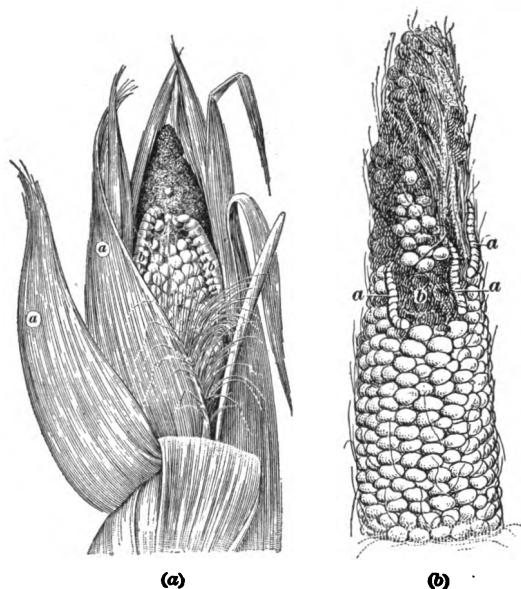


FIG. 22

occasion offers. Because of this fact corn that is planted on sod land is usually injured by the insects that have been living on the grass, and one obvious way of avoiding such injuries is never to plant corn on a field where a sod has only recently been turned under.

**57. The cutworms, wireworms, and white grubs are important enemies of sweet corn. All of these have been discussed in connection with other crops.**

58. The corn worm, or *corn-ear worm*, which is a light-green, round, soft-bodied worm about  $1\frac{1}{4}$  inches long when full grown, has become prevalent over a large part of the United



FIG. 23

States; in the South it is known as the *boll worm*; it is the same insect that attacks cotton. This insect attacks an ear of sweet corn near the tip, works its way through the husk to the soft, developing kernels, and feeds on these until it is full grown. Ears of sweet corn damaged by this insect are shown in Fig. 22. In (a) is shown an ear with the husk pulled back from the tip; the hole *a* through the husk was made by a full-grown worm in leaving the ear; at *b* are shown worms at work on the kernels. A badly damaged ear of sweet corn with the husk stripped off is shown in (b); at *a* are shown worms feeding on the kernels; these worms have worked their way down from the tip; the

injury at *b* was caused by a worm that bored through the husk at that point. Sweet-corn ears injured by the corn worm have an unsightly appearance and are usually unmarketable.

59. The corn worm cannot be reached by a poison spray because it quickly makes an entrance into the interior of the husk and does all its chewing inside. Fortunately for the producers of sweet corn in the North, it does not appear there early in the season.

The best method of control is to plow the land shallowly in the fall, but this is at the best only partly successful. This plowing will destroy many of the cocoons in the ground. When the larval stage is complete, and after the corn worm has done its damage to an ear of corn it will fall to the ground, crawl under the surface, and form a cocoon; when the ground is plowed, these will be crushed and otherwise injured.

**60. Diseases.**—**Corn smut** is the only fungous disease that does any serious damage to sweet corn. An ear of sweet corn attacked with smut is shown in Fig. 23. The disease is well known by all sweet-corn growers. Although it rarely destroys more than a small percentage of a crop, still it regularly takes its toll from almost every field.

No practical preventive measures have yet been discovered for corn smut. A good rotation will help to decrease the damage done by this disease. Some varieties are much more resistant to corn smut than others.

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## HARVESTING AND MARKETING

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### HARVESTING

**61.** Considerable care must be exercised in picking sweet corn. The quality of the corn, and consequently the price that it will bring, depends to a great extent on the time of picking. Two points must be considered: (1) The ears should be of good size; but the size that will bring the best prices will vary in different markets; medium-sized ears will usually sell better than very large or small ears. (2) The kernels should be in the milk stage and be well enough developed to fill out the rows without crowding; when sweet corn has grown a little beyond the milk stage, the kernels get tough and lose their sweetness.

An experienced picker can tell by feeling the kernels through the husk when they are large enough to make the ear marketable. The beginner, however, has difficulty in determining when the kernels are well enough developed, unless he strips

the husk back and looks at them. This stripping back of the husk requires considerable time, more than should be spent, and when the ear has to be left on the stalk for several days after thus stripping part of it, the quality of the corn is injured.

**62.** To secure the best prices, sweet corn should be placed in the hands of consumers a short time after it is picked. Sweet corn deteriorates very rapidly in quality after it is picked, and in 24 hours will have lost most of the delicacy of its flavor, due to the fact that the sugar in the corn kernels turns rapidly to starch. This peculiarity of sweet corn makes strictly fresh-picked corn a luxury, and it is usually so appreciated by the consumer. The gardener who supplies a retail trade can easily pick and market his corn within a few hours; this gives him a big advantage over the trucker; after the quality of a product becomes known in a local market the prices will be good and the sales will be quick.

### MARKETING

**63.** Sweet corn is found in the market from the first part of May until the latter part of October, and usually brings the best prices early in the season, although the prices late in the season are also sometimes good.

In different markets, the market unit varies, but more commonly sweet corn is sold by the hundred or by the dozen.

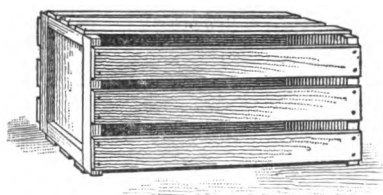


FIG. 24

In the New York market the most common market unit is the hundred; sweet corn is also quoted by the basket, crate, and case.

In the Boston market, sweet corn is quoted by the box, which usually contains 5 dozen

ears with four or five ears added for good measure. The sweet corn shipped north from New Orleans usually comes in barrels, and that from North Carolina usually comes in crates, similar to that shown in Fig. 24; this crate is 12 in. by 24 in. by 12 in. Growers who produce corn for a near-by market find the burlap

sack a convenient package; others merely pack the corn solidly in a wagon body. Sweet corn packed in a basket for a local market is shown in Fig. 25.

**64.** The prices received for sweet corn in the market vary widely, although the gardener who caters to a high-class local trade and who has a high-grade product often manages to secure uniformly high prices. The prices in the large markets are greatly influenced by the supply. Sweet corn is a perishable product, and when large quantities are dumped on the market at once the price naturally drops very suddenly.

Sweet corn uniformly brings the highest prices early in the season, and hence the early crop will show the largest gross returns.

**65.** A careful examination of the wholesale prices of sweet corn in the New York markets for a number of years shows that the price fluctuates from one to several hundred per cent. in almost every month that it is in the market. This indicates that the selling of sweet corn in these large markets is subject to great risks; sweet corn seldom brings as good returns in large markets as in local markets, which are not so likely to be glutted so regularly and so badly.

**66.** In the New York markets, sweet corn is sold in large quantities only during 6 months, from May to October, inclusive. The prices are higher at the beginning of the season than at any other time; they decline steadily until corn goes out of the market. Table II shows the low and high extreme and average prices per hundred ears of sweet corn in the New York



FIG. 25

wholesale markets for the 10 years from 1903 to 1912, inclusive. These prices are figured out from the average of the low and high prices of sweet corn in the markets on the first and fifteenth of each month in which sweet corn was sold during the 10 years mentioned.

67. The prices of sweet corn when sold to the canneries vary from \$9 to \$12 per ton when the corn is sold with the husks on, and about \$3 more a ton when the ears are husked. Large

**TABLE II**  
**PRICES OF SWEET CORN IN THE NEW YORK MARKETS**

Month	Per Hundred Ears			
	Extreme Prices		Average Prices	
	Low	High	Low	High
May.....	\$1.00	\$5.00	\$1.56	\$2.75
June.....	1.00	5.00	1.45	2.93
July.....	.50	4.50	.75	2.33
August.....	.40	2.00	.57	1.83
September.....	.30	2.50	.57	1.66
October.....	.25	1.75	.50	1.30

areas of corn are grown for the canning factories at a contract price of \$10 a ton. Some canneries in Maine pay a certain rate per 100 pounds for sweet corn cut from the cob, commonly about \$2 a hundred pounds, or \$40 a ton. This is undoubtedly the most satisfactory way to pay for sweet corn for canning, because only the useful part of the corn is dealt in, and the grower who produces the best sweet corn makes more than the one who produces inferior corn. The buying of sweet corn for canning on this basis usually results in the stimulation of the production of better corn.

# OKRA, MARTYNIA, AND SWEET HERBS

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## OKRA

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### GENERAL REMARKS

1. **Okra**, or *gumbo*, as it is commonly called in some localities, is a plant that has been imported into the United States. Authorities disagree as to its original home; different ones name Africa, the West Indies, and Central America. Okra, however, was cultivated in Egypt several hundred years before it was known in America, and hence it was probably brought from Africa to the West Indies, and then from those islands into the United States.

Okra belongs to the same family as cotton and the hollyhock, and is commonly a tropical annual, although its habit of growth varies with the climatic conditions under which it is grown, and with the care given to it. In some parts of the South where frosts are rare, okra will grow and produce for several years. In the North, okra is only a half-hardy annual. In its habit of long-continued bearing, the okra plant is like the tomato, but the pods produced late in the season are not as tender, as large, or of as good flavor as those produced early.

2. The okra plant is cultivated for the young, green fruit pods, which are used largely in the making of soups, stews, and catsups. When used in soups and catsups, the extract of the pods gives body to the mixture in the same way that tapioca and sago will do, and also imparts a peculiar flavor to the mass.

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When stewed, okra makes a mucilaginous dish; when so prepared it is simply cooked until it is done, and then seasoned with butter, pepper, and salt. When the stewed okra cools it forms a somewhat semisolid mass, and this is often rolled in meal or crumbs and fried like veal cutlets or fish. A dish is also prepared from okra and tomatoes by stewing the two vegetables together. The pods may also be pickled like cucumbers, canned, and dried for winter use. The young seeds are sometimes boiled and eaten like peas, and the ripe, black or brown, white-eyed seeds are sometimes roasted and used as a substitute for coffee. Like the flavor of olives, the flavor of okra is often disagreeable to many persons at first, but a liking for it is soon acquired.

**3. Commercial Importance.**—The commercial possibilities of okra culture are somewhat uncertain. The plant may be grown over a great part of the United States, but the market for it is somewhat limited, and will continue to be until consumers are educated to its value. The New York City markets are now consuming large quantities of okra, and are demanding more than they can get. A good local trade can be built up for this vegetable in the markets of many small towns. Okra is not a plant of great food value, and probably will never become important commercially to the same extent as cabbage, tomatoes, sweet corn, celery, asparagus, etc., but it will no doubt become much more important than it is at present. A few plants are always a desirable addition to the home vegetable garden.

**4.** The total value of the okra crop in the United States is small as compared with many of the staple vegetables, being only \$24,969 in 1909. In that year 148 farms reported raising 1 or more acres of okra, or a total of 347 acres, which is an average of about 2.34 acres per farm. In addition, large quantities of okra were grown in patches smaller than 1 acre, of which no account is taken in the census figures.

Okra is more extensively cultivated on a commercial scale than is generally appreciated. The principal states in which the crop is raised commercially, in the order of their rank in the

value of the crop produced in 1909, are: Louisiana, Georgia, Texas, Florida, North Carolina, California, Mississippi, Alabama, South Carolina, Tennessee, New Jersey, and Illinois; the first four of these states produced more than 84 per cent. of the total crop. From this distribution of the crop, the fact is brought out that although okra has so far been most extensively cultivated in the Southern States, its culture is also possible in California and in some of the Northern States. Before many more years the commercial culture of this vegetable will doubtless be extended to many other states.

Taking the country as a whole, the average income per acre from okra is nearly \$72. In Louisiana, the first state, the average income per acre is about \$101, and in California the average income per acre is about \$213.

**5. Climatic Requirements.**—As previously mentioned, okra is commonly a tropical annual, but it is versatile in that its habit of growth varies with the climatic conditions to which it is subjected, as well as with the care it receives. Because of this versatility the plant may be grown and made to produce more or less abundantly in almost all parts of the United States. In the South, it is extensively cultivated, and in the region around New Orleans a constant supply throughout the year is obtained from successive plantings. In the North, the plant can be grown only in the warmer part of the year, that is, during the time between spring and fall frosts, because it is very sensitive to frost.

**6. Soils.**—Soils that are considered good for the production of vegetables or cotton are usually good for the growing of okra. The soil should be well drained, warm, and of medium fertility and texture. Okra should not be planted on soil that is excessively rich, as the pods produced on such land are not as early nor are they of as pleasant a flavor as those produced on only fairly rich soil.

## VARIETIES AND SEED

## VARIETIES

7. About fifty varieties of okra are offered by seedsmen; these may be classified into three groups: Tall green, dwarf green, and lady finger. These classes are often further subdivided according to the length and color of the pods, so as to

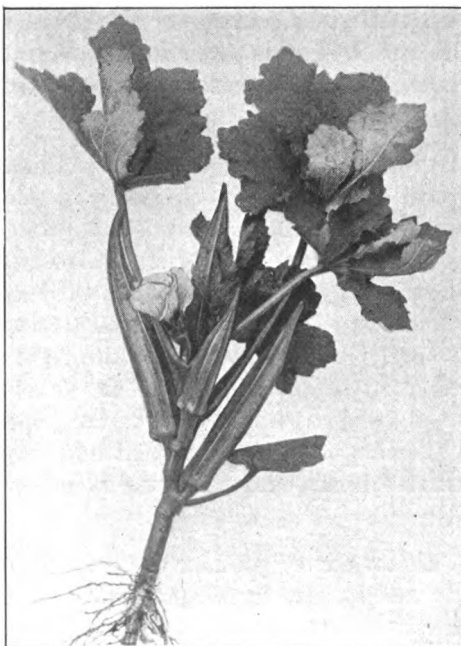


FIG. 1

make six classes: Tall green, long pod; tall green, short pod; dwarf green, long pod; dwarf green, short pod; lady finger, white pod; and lady finger, green pod. Plants that do not belong to any of these classes are mongrels due to cross-fertilization and will seldom produce pods uniform enough in character to command good prices.

The varieties of okra that are best suited to cultivation are those that belong to the dwarf green, long-pod, and lady-

finger classes. The dwarf varieties are usually the more successful in the North, as they bear early. The varieties of okra vary greatly in their characteristics. Some are unproductive and some bear pods so covered with spines that they are difficult to pick, and gloves must be worn while the work is being done. On this account the White Velvet variety is often

recommended in the South, because it is comparatively smooth and may be conveniently harvested.

8. The **Dwarf Prolific** okra, shown in Fig. 1, has a dwarf, stocky growth, the plants growing to a height of 20 to 40 inches or slightly more. The bush grows low and spreading and the



FIG. 2



FIG. 3

leaves are small. The plant of this variety is prolific and bears early; the pods are green.

9. The **Lady Finger**, or *White Louisiana*, okra, shown in Fig. 2, is also a dwarfish plant, growing to a height of 24 to 36 inches, and has a spreading habit of growth. The pods are

from 8 to 10 inches long when fully grown, are slender, slightly curved and taper to the point, are smooth, and of such a pale green that they are often called white.

10. The **White Velvet** okra, shown in Fig. 3, is of a rather tall growth, being about 48 to 54 inches tall. The pods are long, round, usually smooth and seldom ridged, and are of a white color, with a velvety appearance.

11. The **Kleckley's Favorite** okra grows from 30 to 36 inches high and bears an abundance of leaves and pods. A pod is usually borne at each leaf joint. The pods are about 6 inches long, and are thick, fleshy, and tender. The pods are usually smooth and of a pale green or white color.

12. A number of other varieties are offered for sale, the more important of which include *Long Green*, *Green Density*, *Dwarf White*, *Dwarf Green*, *Tall Green*, and *Perfected Perkin's Long Pod*. The distinction between some of these varieties and those previously described is not clear, but the names are given because they are listed in seed catalogs.

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#### SEED AND SEED PRODUCTION

13. Okra seed can be produced in any locality where the plants thrive well, and the main details of the work are about the same as for plants raised for the edible pods, except that the pods are not picked while immature, but are allowed to ripen on the bush. The successful production of high-class okra seed depends very largely on two factors: (1) The selection of plants of the proper type for the production of seed, and (2) the fertilization of the female blossoms of the plants selected for seed production only by pollen from the same variety and from male flowers on the plants that are selected for this purpose.

The plants are grown in the usual way, and those for seed production are selected when the plants are about full grown. The plants selected should be those that set pods the earliest, that are the most prolific and branching, and that have abundant foliage. The central stalks of these plants should produce

one pod about every 2 inches, and the side branches should produce one pod about every 3 inches; if the side branches have sufficient room for development they should bear about as large a crop as the central stem. When a large number of plants are raised especially for the production of seed, matters are usually simplified by cutting out those plants that do not come up to the ideal. When a small grower wants to grow enough seed merely for his own use the following year, he commonly allows some of the plants that set pods the earliest to ripen their seed, and picks the marketable crop from the remainder of the plants. This factor of the early setting of pods is important and attention should be given to it in selecting all plants for seed production.

14. The problem of keeping the okra blossoms from becoming cross-fertilized with pollen from other varieties or from undesirable plants of the same variety is sometimes difficult and usually requires considerable work. In the first place, plants of one variety only should be set in the same plot, and if more than one variety is to be grown, at least  $\frac{1}{4}$  mile should separate the plots, and preferably more, because when planted closer than this there is considerable danger of the plants crossing.

In some cases, however, planting the different plots as far as  $\frac{1}{4}$  mile apart is not feasible, and in such cases pure seed can be produced only by bagging the blossoms and pollinating them by hand. On a small scale this process is very simple, but on a large scale the labor is enormous. When only a small quantity of seed is required the pods that are formed on a few plants in a single day will usually produce sufficient seed, but when large quantities of seed are to be produced a great many pods must be allowed to mature and the blossoms must all be separately bagged, hand pollinated, and then after 1 or 2 days unbagged.

The blossom buds should be closely watched. Shortly before they are expected to open they should be tied up in paper bags; this is usually done in the evening. Early in the morning after the blossom opens the bag should be removed and the pollen transferred to the female flower, the bag immediately replaced, and allowed to remain on the blossom until the stigma has withered, which will commonly be by the following morning,

after which the bag should be removed to give the pod room to develop. The pollen can be transferred by means of a small camel's-hair brush or by means of a small folded leaf. Care should be taken not to mix the pollen from different varieties.

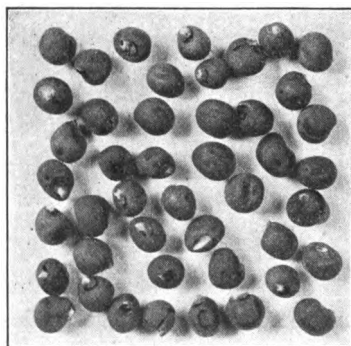


FIG. 4

The brush should be dipped in boiling water and thoroughly cleaned after finishing with one variety, and if a leaf is used it should be thrown away. If care is not exercised in keeping the blossoms covered during the period when the female parts are susceptible to fertilization, the wind or some insect may carry pollen to the blossom and spoil the work.

Many seed growers have not succeeded in satisfactorily controlling pollination, as is shown by the great differences in plants from the same lot of seed.

The seed should be allowed thoroughly to ripen on the plant, the pods should then be cut off, and the seeds shelled out and stored in paper bags and kept in a dry place until spring.



FIG. 5

15. Okra seed is of fair size. From 424 to 510 seeds weigh 1 ounce; on an average, 1 quart weighs a little more than 24 ounces. From 10 to 12 pounds of seed is required to sow 1 acre, and from  $1\frac{1}{2}$  to 2 ounces to sow 100 feet of drill. Okra seed retains its germinating power fairly well for 5 years, and has

been known to do so for more than 10 years, although seed that has been kept 10 years would not be considered safe to plant. Okra seed retails at from 60 to 75 cents a pound.

16. A sample of good okra seed is shown in Fig. 4; this illustration was made from a photograph of seeds of Kleckley's Favorite variety. Okra seedlings are shown natural size in Fig. 5.

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#### PLANTING AND GENERAL OPERATION

17. **Planting.**—As okra seed is very sensitive to cold and to moisture conditions, it should not be sown in the North until late enough in the spring, so that the soil will be well warmed up and all danger of frost be past. In the latitude of New York City, the outdoor planting should not be done before the last week in May or the first part of June, although plantings as early as May 15 are often successful. In the South, okra is often planted at the same time as cotton and string beans, and successive plantings are made at intervals of 4 or 5 weeks in order to give a continuous supply throughout the season. In sections where frost seldom occurs, plantings are made at the convenience of the grower.

In the North, it is often desirable to secure a crop earlier than can be secured by planting seed in the open. In this case, the seed should be sown in a greenhouse or in a hotbed about 4 weeks earlier than the time for sowing in the open. The seedlings are particularly difficult to transplant successfully and for this reason they should be grown in pots (preferably paper pots) in flats, in baskets, or on inverted sods. When grown in a pot, each plant can be transplanted with the large ball of earth in which it grew in the pot, and it will receive but little shock from the transplanting.

The distances for planting okra depend on the variety planted. Some of the dwarf varieties may be planted in rows  $2\frac{1}{2}$  feet apart, although many authorities claim that no okra plants should be set in rows less than 3 feet apart. The latter distance gives more room for cultivation and more room for the symmetrical development of the plant. The larger varieties are planted in rows farther apart, at distances up to 5 feet apart.

The seed should be sown thickly in the rows to allow for an imperfect germination. They may most conveniently be sown with a seed drill, should be spaced 2 inches apart in the rows, and should be planted from 1 to 2 inches deep. After the plants have attained a growth of 6 inches they should be thinned so that only the best of them will remain. The plants of the dwarf varieties should be thinned to stand about 1 foot to 14 inches apart in the rows, and the plants of the larger varieties from 18 inches to 3 feet apart. Vacant places can be filled

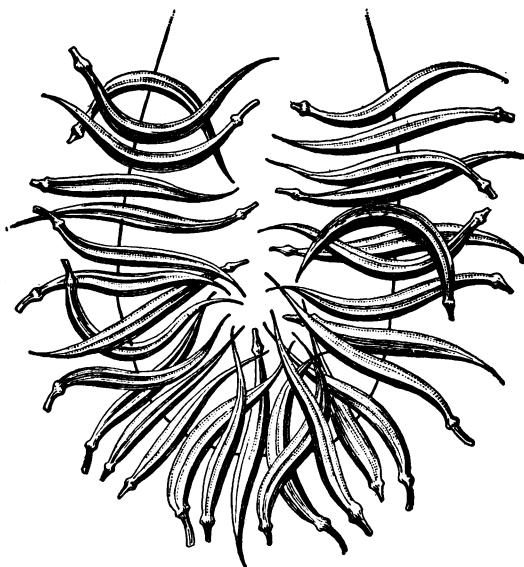


FIG. 6

by transplanting. When the plants are transplanted in the field, of course, they are set at these distances originally. When planted in this way, from 10 to 12 pounds of okra seed will be required for 1 acre, and about  $1\frac{1}{2}$  ounces or a little more to 100 feet of drill.

**18. Cultivation.**—Okra may be grown as easily as sweet corn or cotton and requires similar cultivation. The ground should be well stirred and a good dust mulch maintained,

especially while the plants are small. One object of the cultivation is to conserve all the moisture possible, as the plants require large quantities of water for early development to a good size. As soon as the leaves begin to shade the ground, however, the necessity for continuous cultivation is lessened; yet it is important to keep the weeds down, and to maintain a mellow condition of the soil. In some localities irrigation is necessary to produce a good crop.

In some parts of the South, okra and cotton are grown as companion crops on the same land, the greater part of the okra crop being harvested and the plants cut out before the cotton begins to mature. This practice is rarely advisable, however, as both of these plants require large quantities of nitrogen, and when grown on the same piece of ground at the same time they greatly exhaust the soil.

**19. Fertilization.**—Okra requires about the same fertilization as sweet corn, and in many parts of the South it is fertilized in the same way as cotton. The object of applying fertilizers to okra is principally to secure a quick, vigorous growth early in the season, so that the plants will come into bearing early. For this reason, nitrogenous fertilizers are particularly beneficial early in the season. The fertilization of okra, however, should not be overdone, or, as explained elsewhere, the pods may not be borne as early as desirable, and their flavor may not be good.

**20. Drying.**—The drying of okra is a very simple matter, and is largely practiced in Turkey and Egypt, and to a lesser



FIG. 7

extent in some parts of the South. The most common way of drying okra is to string the pods by running a thread or fine wire through them, as shown in Fig. 6, and to hang them up on the rafters of a cool loft or some similar place to dry. In some sections small okra pods about  $\frac{1}{2}$  inch in length are strung as shown in Fig. 7.

A method of drying used in the South to some extent is to cut the okra pods in  $\frac{1}{2}$ -inch cross-sections, spread the sections out on cloth to dry in the sun, and then pack them in paper bags, which are kept in a dry place.

**21. Insect Pests and Injuries.**—A number of insects, such as aphids, or plant lice, leaf hoppers, some plant bugs, some forms of caterpillars, the cotton bollworm, and other insects that feed on the cotton plant, have been found feeding on okra, but so far none of these are known to do any serious damage.

Okra, however, is subject to several fungous diseases to such an extent that the raising of this crop on some fields is impracticable. No method of control is known for these fungous diseases except to starve them out by depriving them of their host plant, and for this reason rotation is recommended as a means of avoiding loss from them. Whenever okra is attacked by fungous diseases it should not be grown on the same land again for 3 or 4 years.

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## HARVESTING AND MARKETING

**22.** To be thoroughly successful, the harvesting of okra pods must be frequently and carefully done, and the product must be promptly shipped to the consumer. The green fruit pods are the marketable part, and these must be harvested just at the proper time.

The okra plant is a vigorous grower, and the fruit pods develop so rapidly as to necessitate the gathering of the product daily. This should preferably be done late in the afternoon. To appreciate the importance of regular, careful, and systematic harvesting, the habit of growth of the plant and the proper stage for harvesting should be understood.

The flower of the okra is very short lived. It opens during the night or early in the morning, and lasts only a few hours, the pollen being transferred from the male to the female blossoms during this short time or not at all. The pod formed from a flower fertilized on one morning will normally be ready for harvesting about the latter part of the next day, or about 36 hours or so after fertilization takes place; the exact time for producing pods of marketable size will, of course, vary somewhat with the local conditions and the age of the plant.

The size at which the pods should be harvested varies with the variety, but the stems should never be allowed to become stringy, and should preferably be brittle enough to snap off between the fingers. The pods should always be soft and the seeds not more than half grown. After a little experience, the proper time for picking the pods can be easily determined at a glance.



FIG. 8

**23.** Parts of two okra plants, with the blossoms and pods in various stages, are shown in Fig. 8. The flower shown at *a* has just been fertilized and will fade and drop off within a few hours. The pod at *b* is shown with the blossom just coming off of it. The pods at *c* are shown just after the blossoms have fallen, and the pods at *d*, *e*, and *f* are shown in different stages of growth. The pod shown at *e* is at the proper stage of development for picking; it was developed from a flower that was fertilized the previous morning.

The pod at *f* is in its third day of growth and is a bit too far along for eating; pods should not be allowed to develop to this stage unless the plant is to be used for seed production, because when pods are allowed to mature the production of pods later on is diminished.

A knife should never be used in harvesting okra; the stem should be broken off with the fingers. This is easily done with such varieties as the White Velvet, because of the absence of spines. When a knife is used in harvesting okra, there is danger of cutting the stalks of the plant and thus stopping the fruiting. The pods should be detached from the plant with 1 to 2 inches of stem attached, so that wilting in transit will be lessened.

While gathering the edible okra pods, a few moments spent in removing the stiff, dead flowers from about the base of all small pods will be amply repaid by later results. When these dry, dead flowers are left they are quite likely to contract around the young pods and either retard their growth or even destroy them.

All pods should be gathered from a plant while they are still soft and tender and before the seeds are more than half developed, regardless of their size. If they are left on the plant to mature they will check the production of other pods.

**24.** Immediately after being harvested, the pods are graded according to size and packed. The pods should be packed in the packages firmly to prevent bruising. The pods should never be shipped in tight packages or in bulk, as they have a tendency to heat and spoil under such conditions.

Okra should be harvested and shipped promptly so that it will be delivered to the consumer within at least 36 or 48 hours after it is picked. In some cases, however, okra has been successfully kept in cold storage for several days at a time, and has even been kept in a cool room or a cellar, by spreading the pods out in single layers on wooden benches or trays and moistening them to prevent them from heating. Usually, however, the pods should be handled quickly and sold promptly.

**25.** Okra is considered one of the luxuries, and is sold in much smaller quantities than many of the other vegetables, but it sells at relatively high prices. In the larger markets, okra is

offered for sale every day in the year, the supply coming largely from the South. The fluctuations in price are due largely to the supply and demand and the quality of the product when it reaches market. Okra that was of good quality when shipped often arrives in market in poor condition because of improper packing.

Okra most commonly comes into the New York wholesale markets in carriers, containing six 4-quart baskets, like that

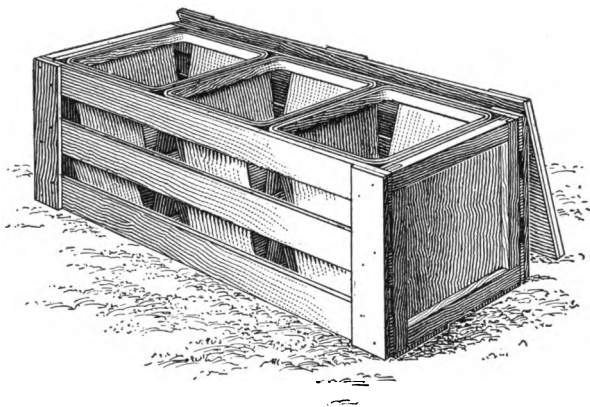


FIG. 9

shown in Fig. 9; this is the same as the Georgia peach carrier. At odd times in these markets, okra is sold also by the box, basket, and large half-barrel basket. In some local markets it is sold in the same package in which tomatoes are sold. Sometimes it is packed in quart strawberry baskets, or in pint raspberry baskets and these packed in crates.

The price for okra of good quality varies considerably in each month, but the average price is usually satisfactory. The higher average prices are received during the cooler months, when the product has to be shipped from points farthest South. The highest price is received in February; from then on the price declines until it reaches its lowest point in August and September; it then increases through the fall and winter until February. Remunerative prices are received for first-class okra from November until July.

Table I shows the extreme and average low and high prices per carrier of okra in the New York markets for the 10 years from 1903 to 1912, inclusive. These figures are based on the

**TABLE I**  
**PRICES OF OKRA IN THE NEW YORK WHOLESALE MARKETS**

Month	Per Carrier			
	Extreme Prices		Average Prices	
	Low	High	Low	High
January.....	\$1.00	\$6.00	\$1.43	\$4.18
February.....	1.00	9.00	1.65	4.55
March.....	.50	6.00	1.33	4.05
April.....	.50	5.00	1.30	3.50
May.....	.50	5.00	1.25	3.56
June.....	1.00	4.00	1.35	2.98
July.....	.50	4.00	1.23	2.68
August.....	.25	2.00	.68	1.18
September.....	.25	2.00	.68	1.11
October.....	.50	2.50	.88	1.78
November.....	1.00	3.50	1.50	2.59
December.....	.75	5.00	1.47	3.42

average prices on the first and fifteenth of each month for the 10 years mentioned; they furnish a good guide for the marketing of okra.

## MARTYNIA

**26.** *Martynia*, or the *unicorn plant*, is a vegetable that is grown to a limited extent for the half-matured seed pods that are used for making pickles. Two or three species of *martynia* are in cultivation; the commonest and best known species is a

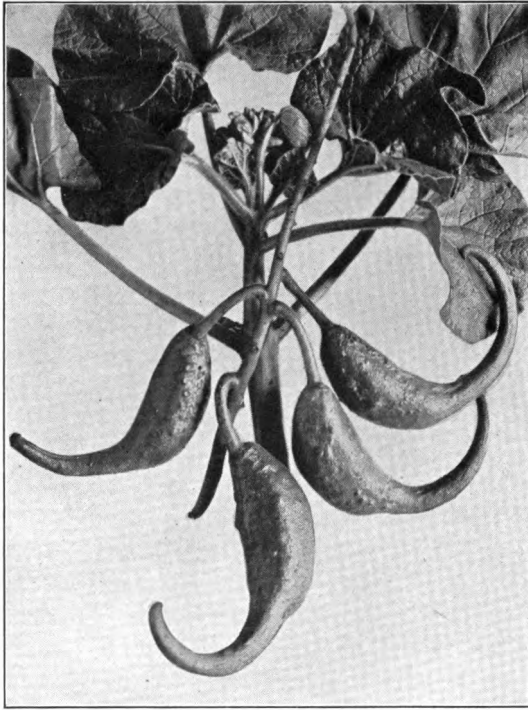


FIG. 10

native of the region extending from the southern part of Indiana to Iowa and southwards. The other species are natives of the tropics, and all are annuals. The plant may be raised in practically all sections of the United States.

A part of a martynia plant showing the fruit and leaves is illustrated in Fig. 10. This plant grows to a height of about  $1\frac{1}{2}$  feet; it has a nearly prostrate growth, and often has a spread of 3 to 4 feet across. The leaves of the plant are heart shaped, large, and hairy; the flowers are violet in color and are large and attractive; and the pods are long, pointed, and beaklike. Whenever the conditions of growth are favorable, the fruit pods are borne in great abundance.

In the North, the seed should preferably be sown in pots in a hotbed or greenhouse in April or May and transplanted to the open in June. When handled in this way, the half-grown pods will be ready for harvesting in July and August. In the South-

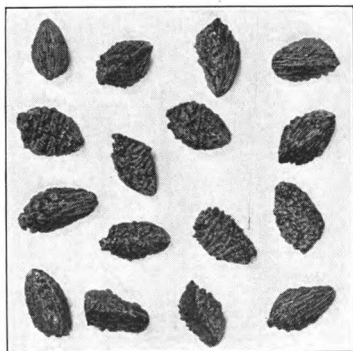


FIG. 11

ern States, and in most of the Middle States, the seed may be sown directly in the open about the same time that okra seed is sown. To allow the plants room for full development, the seed should be sown in hills 3 to 4 feet apart each way. Three or four seed should be sown in a hill, and after the seedlings are up to a height of a few inches they should be thinned out and only the best one allowed to remain.

Only fresh seed should be used for planting. Martynia seed will not always retain its germinating power satisfactorily for the second year. There are about 560 seeds in 1 ounce, and, according to the method of seeding and the germinating power of the seed, from 10 ounces to  $2\frac{1}{2}$  pounds of seed will be required to sow 1 acre; 1 quart of seed weighs a little more than 11 ounces. Martynia seed retails from seed houses at about \$3 a pound. A sample of martynia seed is shown in Fig. 11.

The cultivation and general care of martynia is about the same as that for okra, and no special treatment is necessary.

The pods, or capsules, should be picked when about half grown. They are small and tender, and are pickled like cucumbers.

## SWEET HERBS

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### GENERAL REMARKS

**27.** *Sweet, condimental, flavoring, or culinary*, herbs are not grown as extensively in America as in Europe, but a list of from ten to twenty herbs will be found in most American seed catalogs. Most of these herbs are of interest only to the home gardener, but a few of them are grown commercially in certain localities.

Plants that are called herbs comprise a great variety of forms. Some are useful for medicinal purposes, some for flavoring, some for garnishing, some for salads, and others for keeping moths out of clothing, etc. The sweet herbs are the ones most commonly used in cooking, and of these sage is the most popular.

The following lists, arranged by Professor L. H. Bailey, contain the leading species of sweet herbs cultivated in the United States, arranged approximately in the order of their duration (many other plants of minor importance might be included in these lists):

*Annual herbs, or those grown as such:* Anise, sweet basil, summer savory, coriander, caraway (biennial), clary (biennial), dill (biennial), sweet marjoram (biennial or perennial).

*Perennial herbs:* Sage, lavender, peppermint, spearmint, hyssop, thyme, marjoram, balm, catnip, pennyroyal, rosemary, horehound, fennel, lovage, winter savory, tansy wormwood, costmary, tarragon.

The herbs in these lists that are grown to a relatively large extent commercially are discussed in the following pages.

### DILL

**28.** Dill is related botanically to parsley and fennel. It is a native of Southern Europe, but has been grown in the United States for a long time. It is cultivated largely in home gardens, but is also grown to some extent commercially to supply a limited demand for it during the pickling season in the fall.

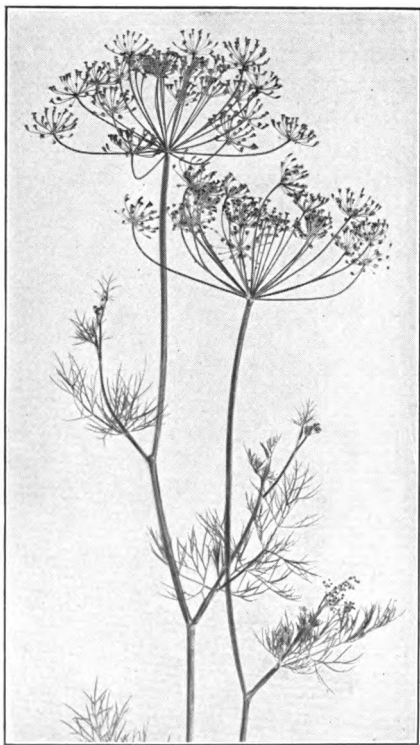


FIG. 12

The plant is a biennial but is grown as an annual, and grows to a height of 2 to 3 feet. The leaves are finely cut, being almost thread-like. The blossom stalk is tall and smooth. The flowers are yellowish, and the petals are small and fall off early. The top of a dill plant is shown in Fig. 12.

The leaves of dill are sometimes used for culinary purposes for flavoring. The seeds are flat, aromatic, and bitter flavored, and are sometimes added to the brine of cucumber pickles to produce the common dill pickle. The foliage is used occasionally in medicine, principally for flatulence, or gas in the digestive tract, and for

colic in infants. The plant is sometimes grown in localities where it is desired to attract honey bees, as these insects seem to be partial to the aroma given off by it.

The dill plant is hardy but grows to best perfection in a warm location. It will do well in almost any soil, but will, of course,

grow most luxuriantly in a fertile, well-drained soil; preferably, the soil should be light.

**29.** Dill is easy to grow. The seeds should be sown either early in the spring, or soon after they ripen in the late part of the summer. The seed is sown thinly in drills from 20 to 24 inches apart, and if the plants begin to crowd they should be thinned to stand about 8 inches apart in the row. Clean cultivation should be practiced throughout the season.

The tops of the dill plant are cut in 15-inch lengths for market, and are tied in small bunches. These bunches are commonly seen in the city markets in the early fall. On a small scale, the culture of this plant is usually profitable.

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## MINT

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### PEPPERMINT

**30.** **Peppermint** is the most important commercial species of mint. It is one of the most important of the plants used in the production of the essential oils. Peppermint was originally a native either of Great Britain or of Continental Europe, or of both. It was introduced into the United States in the early part of the 18th century, being first grown in Connecticut, and is now found growing as a wild plant in many parts of both Europe and America. The plant is now grown on a commercial scale in many parts of the United States, principally for the purpose of producing peppermint oil.

Peppermint has a strong, pleasant odor, and a pungent, aromatic taste; it produces a sensation of coldness in the mouth. The peppermint oil is extensively used in confectionary, such as candy and chewing gum. The oil is used in medicine because of its aromatic, stimulating, and stomachic properties.

**31. Climatic Requirements.**—Peppermint is hardy and will succeed in most parts of the United States where the rainfall is sufficient or where water can be applied artificially. If the plant can be grown in a location where it is sheltered from the

midday sun, however, it will develop to its greatest perfection, will grow vigorously and will remain productive for the greatest length of time. In the garden, it is often planted in a border near a wall or so that a tree will shade it in the middle of the day. Commercially, the securing of shade at midday is a more difficult problem.

**32. Soils.**—Peppermint requires a strong soil for its best development, and one that is moist or even wet, if it is well supplied with organic matter. It is often found growing naturally along water courses. Generally speaking, peppermint may be grown on any soil that will produce a good crop of corn, but the most profitable crops have been secured on muck soils that have an abundance of moisture.

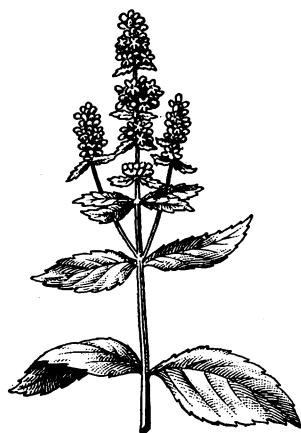


FIG. 13

Peppermint quickly exhausts the average soil on which it is grown. On upland soils it should be grown in a rotation with other crops and large quantities of humus and nitrogen applied to the soil. On the average upland soil, peppermint should not be grown more often than once in 4 to 5 years. Successive crops of peppermint on an upland soil will rapidly diminish in

size. On deep, rich, moist, muck soils, peppermint has been grown 6 and 8 years in succession without a decrease in yield.

**33. Varieties.**—Several varieties of peppermint are grown in different localities, but only three are of much importance.

**34.** The **American**, *New York State*, or *Old-Fashioned*, peppermint, illustrated in Fig. 13, is the most common kind. It has been cultivated for many years in the United States, and is sometimes found growing wild.

**35.** The **Black**, or *Black Mitcham*, peppermint is a native of England and was introduced into the United States about

1888. It is more productive than the American peppermint, and is widely cultivated in Europe and America.

**36. The White, or White Mitcham,** peppermint is of fine quality and yields a high grade of peppermint oil, but it is less productive than either of the preceding kinds, and is not hardy enough to prove profitable commercially.

**37. Propagation.**—Peppermint is commonly propagated by divisions of the roots, called clumps; the new growth that comes from these pieces actually springs from pieces of running rootstocks, or runners, attached to the roots. On upland, from two to three crops can usually be secured from a plant grown from a piece of root. When the plants begin to fail they are dug up, the older parts of the roots are discarded and the younger and more vigorous parts are cut in pieces and replanted. In swamp lands, the plants may be plowed under after each harvest and the runners will renew the crop indefinitely.

Peppermint, and the other mints, may also be propagated by means of seed, but the seedlings are not usually vigorous enough to bear much of a crop until the second year. If the soil is rich and the seed can be planted very early in the spring, a light cutting can sometimes be made in the fall of the first season.

Few seed houses list the seed for sale. They commonly offer the clumps, or roots. In small quantities, they sell for about \$1 a dozen; in large quantities, they can of course be secured much more cheaply; they can usually be secured at a reasonable figure from growers.

**38. Planting and General Management.**—The clumps of peppermint roots should be planted as early in the spring as possible, so that the plants will get a full season's growth and develop a good crop of foliage by fall. They should be set in shallow furrows 30 inches apart and about 12 inches apart in the row.

When the seed is used, it is sometimes sown in beds and the plants allowed to develop at random, but better results are obtained if the seed is sown in drills from 18 to 20 inches apart, and the plants thinned to stand from 5 to 6 inches apart in the

row. When the plants grow large enough to crowd at these distances they can be transplanted to stand as recommended for the clumps.

Thorough cultivation is particularly essential to secure a large crop and one that is free from obnoxious weeds. Ragweed, fireweed, horseweed, and others that have bitter or aromatic properties are particularly undesirable. If such weeds are cut and distilled with the peppermint, the oil secured will be of a low grade. On weedy land, it is often necessary to do considerable hand hoeing and even hand pulling to keep down the growth of weeds.

**39. Harvesting and Marketing.**—Peppermint is commonly cut with a scythe or with a mowing machine. In the latitude of New York City, this is commonly done in August or in the early part of September. Probably the best time for cutting is when the first flowers have developed; the cutting should not be delayed until the leaves have begun to fall. In long seasons when the growing conditions are favorable, a second cutting can sometimes be obtained about 2 months after the first.

Peppermint plants that are intended for the production of peppermint oil are cured like hay after they are cut, being raked into windrows and allowed to dry to a certain extent. They are then taken to a still, where the oil is extracted from the foliage by distillation with steam. The crop from 1 acre of peppermint should yield from 10 to 50 pounds of peppermint oil; about 25 pounds is a fair average.

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#### SPEARMINT

**40. Spearmint** is of less commercial importance than peppermint, but is perhaps grown more extensively than peppermint for sale in a fresh state. It is more largely used for culinary purposes and less used for medicinal purposes than peppermint.

For an herb, spearmint is cultivated both in the field and in greenhouses on a fairly extensive scale in the vicinity of many large city markets, where the freshly-cut sprigs are used for

flavoring drinks, and the foliage of the plant is used for preparing sauces for meats, particularly lamb. In some localities, spearmint is also grown for the production of spearmint oil, although there is a much smaller demand for this than for peppermint oil. Spearmint oil is used in medicine for its aromatic, stimulating, and stomachic properties, to some extent for flavoring drinks, and in confections. Spearmint oil is distilled in the same manner as peppermint oil.

Spearmint, like peppermint, is a hardy perennial, and is found growing wild in many sections of the country in moist land, often along water courses. It is found growing wild in many old gardens in the older parts of the United States. It is a native of Europe and Asia. The branches grow more or less erect to a height of 6 to 8 inches. A sprig of spearmint is shown in Fig. 14.

Like peppermint, spearmint will do well in all the climatic conditions found in the United States, provided sufficient moisture is present. It will thrive in almost all soils that are fairly fertile and that are not too dry.

Spearmint may be propagated and cultivated in the same manner as peppermint.

Under intensive cultivation it will yield well and give good returns on a small scale. In the home garden it will continue to grow year after year with little care.

A few insect pests and fungous diseases attack spearmint, but no attempt is made to combat them with sprays. The best plan is to fertilize liberally and to cultivate cleanly. When these

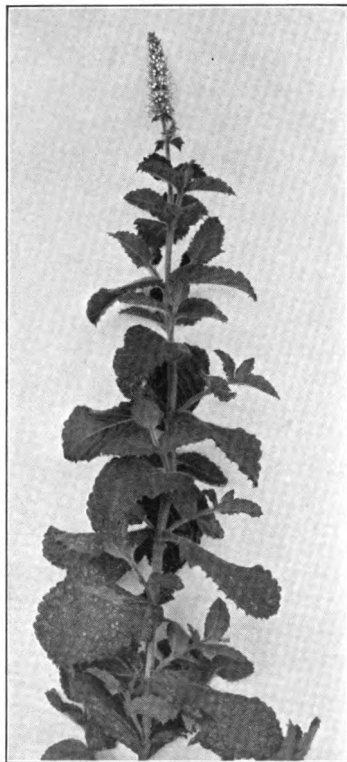


FIG. 14

things are properly attended to, the damage done by the pests of the plant will not be serious.

The crop is harvested by cutting the stems close to the ground, which will make from 6- to 8-inch lengths. These branches are tied in bunches from 1 to 2 inches in diameter.

The market for fresh sprigs of mint is as extensive as for any of the herbs. The best market is early in the spring, when considerable quantities of spearmint sauce is used on meats. There is little sale for it during the summer months, but there is a fairly constant demand for it during the fall and winter.

Mint is sold wholesale by the dozen bunches, the prices ranging from 25 cents to as much as \$2.50 and more per dozen bunches.

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#### SAGE

**41.** *Sage* is the most popular and most widely grown of the culinary herbs, except parsley; parsley is more generally used for garnishing than for flavoring. Sage is a native of Southern Europe and has been cultivated since the earliest times.

Sage is a fairly hardy, fibrous-rooted, perennial, evergreen shrub. The plant grows to a height of about 2 feet. It is grown for the leaves, which are wrinkled, ashy, or whitish green, and oval in shape; they are borne along branching stems about 18 to 20 inches long. Flowers, generally blue, are borne on the ends of the stems early in the summer; sometimes pink or white flowers are found. The seeds are black and spheroidal and are borne in open cups.

The leaves are most commonly used for flavoring sausages, soups, stews, cheese, and dressings for certain meats, particularly, pork, goose, duck, turkey, etc. The leaves are strongest when used fresh. They have a fragrant odor, and a warm, bitterish, aromatic taste. When carefully dried the leaves may be kept for winter use, but even when dried according to the best practice some of the volatile oil, which gives them their aroma, is lost. When carelessly dried nearly all of the aroma is lost. Sage is used to a limited extent in medicine, although not so much now as in ancient times; it is used as a tonic, for its stomachic properties, and for various other purposes. The

name sage was given to this plant by the ancients because of its supposed power of making people wise by strengthening the memory.

Sage does best when planted in a sunny, open exposure. It is fairly hardy, but requires mulching for best results in the northern parts of the United States.

To make its best growth, sage requires a well-tilled medium garden loam soil. The soil should be fertile and rich in nitrogenous matter and humus. Good drainage is also essential.



FIG. 15

If the soil does not contain sufficient humus the supply can be increased by adding stable manure or by plowing under cover crops.

**42. Varieties and Seed.**—Several different kinds of sage are listed by American seedsmen, although most seedsmen simply refer to the plant as sage without listing any specific

varieties. The kinds usually listed are: the common sage, the broad-leaved, and the red, and purple. In America, the kinds having broad, green leaves are usually preferred to those having narrow, colored leaves, and hence these should have preference. The **Holt Mammoth**, leaves of which are shown in Fig. 15, is one of the best varieties that conforms to the American requirements.

Sage seed retains its power of germination for about 3 years, but it is usually better to use 1-year-old seed. It can be purchased from seed houses in pound lots at about \$1.50 a pound.

**43. Propagation.**—Sage may be propagated by seeds, cuttings, layers, and by division of the roots into clumps. Commercially, seeds and cuttings are relied on.

In propagating by means of seed, the seed may be sown either indoors under glass or outdoors. Commercially, the plants are commonly started under glass. The seed is sown in a greenhouse, a mild hotbed, or a cold frame, according to the climate and the time of year, and should be sown as early as possible in the spring so as to obtain early plants for field setting. The seed should be sown thinly in drills about 4 inches apart, should be planted about  $\frac{1}{2}$  inch deep, and the soil should be pressed down firmly above them. When the plants are well up they must be transplanted to another bed under glass. They should be hardened off before they are set in the open. If planted early in the spring, the plants should be about 2 to 3 inches tall by June 15 or July 1, when they will be needed for setting in the field.

When the seedlings are to be grown outdoors, the seed should be sown thinly in drills about 8 inches apart and should be planted about  $\frac{1}{4}$  to  $\frac{1}{2}$  inch deep. They should be planted as soon as the ground becomes dry enough so that it can be well prepared. When the seedlings are well started they should be thinned to stand 6 inches apart in the row; the seedlings that are taken out should be transplanted in another part of the seedbed at the same distances; this is the most economical way, but the transplanted seedlings may not do well unless they are carefully handled. The soil should be kept light and friable and

free from weeds. The seedlings will be ready for transplanting to the field either in the autumn or the following spring.

Cuttings may be made of either the mature or the immature parts of the sage plant. Mature wood cuttings are more commonly used when the sage is to be the second crop on the land, following some early crop like early beets, early cabbage, or early peas. The mature cuttings are made from the central growth of the old plants early in the spring, are set in rows about 6 inches apart in a moist, shady place, and should be ready for setting in the field in about 6 weeks. Plants grown from these cuttings will bear a crop the same year.

Immature wood cuttings should be taken from the outside shoots of the current year's growth, just before the time when blossom heads are ready to form on the shoots. These cuttings are planted in beds in rows 8 inches apart and 6 inches apart in the row. If the spot is moist and shady they will quickly take root and spring into growth. Like the seedlings, the plants from the immature cuttings are left in the cutting bed until fall or spring; they are then carefully taken up and set in the field. Plants from immature cuttings are usually more prolific than those grown from mature wood or those grown from seed, and are therefore usually considered to be the best to use when sage is the only crop to occupy the land during the season.

When an early crop precedes the sage on the land in the spring, plants produced from seed or from mature wood cuttings, the former preferred, are considered to be better than those from immature wood. The seedling plants usually yield better than those from mature wood cuttings, although the crop is likely to be later, very little, if any of the tops being ready for harvesting before September in the latitude of New York City.

All growers will not agree with these statements, as each method has its own advocates, but the facts as given represent the experience of the greater majority of growers. In special locations, results may occasionally be found to vary.

In gardens, the clumps of sage plants are commonly divided and replanted every 2 years, to prevent the plants from growing long and straggling. The new plants are set at about the same distances as those from seed or from cuttings.

The sage plant can also be propagated by mound layering the shoots. This is done by mounding up earth around the shoots; roots will be thrown out from the shoots and new plants formed. When well rooted, these can be transplanted the same as those grown from seed or from cuttings.

Propagation by division or by layers is not important, and is not practiced commercially. Propagation from seed or from cuttings is much more satisfactory.

**44. Planting and General Management.**—The preparation of the soil for sage should be thorough. The soil should be plowed deeply, in most soils as deeply as the depth of the surface soil will permit. If sage alone is to occupy the land during the season, the best results are secured by plowing the previous fall. If an early crop precedes the sage on the land in the spring, the ground should be plowed before the sage is planted. Before plowing, a good dressing of well-rotted stable manure should preferably be applied. The land should be well harrowed as for any small garden crop; good soil preparation is essential.

The time for planting sage has been discussed somewhat under propagation. If sage is to be the only crop on the land during the season, the plants should be set in the field early in the spring, even before danger from frost is over, since the plant is hardy, so that an early crop can be secured in the fall. If sage is to be the second crop on the land, it should be planted not later than the latter part of June or the first part of July in the latitude of New York City. As previously mentioned, plants from immature wood cuttings are best for the early spring plants, and plants from seed or from mature wood cuttings, the former preferred, are best for the later plantings.

In the field, the distances for setting the plants vary. When the soil is to be cultivated by hand, the rows may be spaced as close as 15 inches; when horse tillage is to be practiced, they should be spaced from 20 to 24 inches apart. Most growers prefer to space the plants about 10 inches apart in the row; a few growers, however, claim to secure good results by crowding them as close as 6 inches apart in the row. In small patches in the garden, the plants are often set 12 inches apart each way.

The plants should be set at the same depth at which they stood in the seed-bed or in the cutting bed, and the soil should be well compacted about them. The roots should be covered so that they will not dry out, and in some cases the tops should be trimmed back somewhat.

**45.** The cultivation for sage should be clean and thorough. Weeds should not be allowed to gain headway or the productivity of the plants may be greatly injured. About two or three times during the first 3 weeks after the plants are set in the field the soil should be carefully cultivated. All weeds should be killed and the surface soil loosened up. If this work is well done and the soil is not exceptionally weedy, an occasional hoeing thereafter should be sufficient. If the preliminary cultivation is not well done, the later cultivation may be too late to prevent the weeds from injuring the plants.

Sage responds well to commercial fertilizers. If a good coating of manure has been applied before sage is planted, commercial fertilizer may not be necessary in a good soil. About 1,000 pounds of a good truck fertilizer, such as a 4-8-10 fertilizer, applied broadcast before the plants are set, will commonly be sufficient. A top dressing of from 150 to 200 pounds of nitrate of soda per acre can also often be used to advantage.

In Northern localities, sage will have to be mulched during the winter in order to come through the cold weather in condition to bear a good crop the following year. The mulch should be put on after the harvest is over. Marsh hay or some material that contains no weed seed that will succeed on the upland is the most suitable. In the South, the sage plant lives over winter without protection.

**46.** Although sage is a perennial, it will not be found to yield good crops after 2 or 3 years of bearing. After that the crop diminishes both in quantity and in quality. Some growers develop their new plants from seed; others prefer to develop them from mature wood cuttings in order to save time. In this way only the first lot of plants on the farm is developed from seed, and all future plants are made from plants grown from mature wood cuttings. Although the crop is not so heavy from

mature wood cutting plants, this plan has the advantage of allowing an early crop to be taken off of the ground before the plants are set out. The advisability of pursuing this plan depends on the ease with which an early crop can be sold and whether the combined returns from this and a medium crop of sage will be greater than that from a large crop of sage as the only crop from the land during the season.

**47.** The sage plant is singularly free from insect pests and diseases, and no measures for preventing loss from these causes are necessary.

**48. Harvesting and Marketing.**—The harvesting of sage consists merely in cutting off the stems near the crown and tying them in bunches. Late in the summer or early in the fall the stems are cut fairly close to the crown; late in the fall or in the winter the leaves should not be cut so far down that there will be a likelihood of the crown being injured by cold during the winter. Sage should always be harvested before the flower stems begin to develop, because the leaves have a richer, more aromatic odor before this time than later, and because when it is cut early enough to prevent the flower stems from forming there is sufficient time for another crop of leaves to develop.

In harvesting sage, two cuttings are usually made in order to secure a larger crop than can be obtained in one cutting; especially vigorous plants that are grown from cuttings will sometimes give three crops in a season, although this is seldom, if ever, counted on commercially.

In the latitude of New York City, the first cutting from a commercial crop of sage is commonly made late in August or in the early part of September. Then if the stumps are not cut down too closely to the crown another crop can be cut from the same plants late in the autumn. At the first cutting, each sage plant should yield about two bunches, or a little less, and at the second cutting vigorous plants should yield about three marketable bunches.

Some growers find that they get the best results from two cuttings by handling the plants in the following way: The plants are spaced closely together, and when they begin to crowd

late in the summer the first cutting is made. At this time all the tops are cut and either every alternate plant in the row is removed or all of the plants in alternate rows are cut; probably the former way is the best. The remaining plants are allowed to grow to full size and are cut late in the fall when they fill or nearly fill the space. When handled in this way, the sage plants will be very bushy, the cuttings from all the plants will be full of leaves, and the yield will be greatly increased.

Sage is sold by the bunch, which is similar in size to the mint bunch. It meets with a ready though somewhat limited sale. On a small scale the crop is a profitable one in most localities.

**49. Drying.**—Sage that is to be kept for winter use must be carefully dried or decay will set in, and the flavor will be lost. A small lot of sage can be readily dried in a small, well-ventilated room. The bunches of plants are simply hung up on the ceiling and walls or are laid in a thin layer on a floor or on racks and allowed to remain there until dry. The room should be ventilated sufficiently to keep the air dry. A little heat may at times be necessary to maintain a dry atmosphere.

When the plant is to be dried on a large scale, a special drying machine must be used. A common fruit evaporator that will keep a steady current of air warmed to about 100° F. passing over the leaves is suitable.

After they are dried, sage leaves are commonly rubbed to a fairly fine powder; this is stored in tin cans or other air-tight containers.

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## SAVORY

**50. Savory** is a name applied to two very similar plants of the same botanical family that are cultivated as sweet herbs, namely, *summer savory* and *winter savory*. These plants are grown for their aromatic foliage and shoots, which are used in flavoring soups, salads, meats, dressings, etc. Summer savory was formerly much used in medicine.

**51. Summer savory** is a hardy annual and a native of Italy; it grows slender, erect, with branching stems, to a height

of about 10 to 12 inches. The leaves are soft, smooth, narrow, and green. The flowers are pink, purplish, pale lilac, and white, and are borne in clusters. Tops of summer savory are shown in Fig. 16. There are no distinct varieties.

The seeds are brown in color and ovoid in shape. They retain their power of germination for about 3 years. The seed can be readily produced by allowing some of the plants to go to seed; plants intended for seed production should not have any foliage cut from them, because this will tend to reduce the quality of



FIG. 16

the seed. The seed can be purchased at retail from reliable seed houses at about \$2.50 a pound in pound lots.

Summer savory is propagated by means of seed. These should be sown as early in April or May as the ground can be made fairly warm. The soil should be light, mellow, and well drained. The seed should be sown fairly thickly in shallow drills from 12 to 18 inches apart, and should be covered lightly. When the plants have grown to a height of 2 to 3 inches they should be thinned to stand about 6 inches apart in the row; the seedlings that are taken out may be easily transplanted.

An extra early crop of summer savory can be secured by sowing the seed in a hotbed early in March and transplanting the seedlings when the weather is favorable.

The ground should be kept cleanly cultivated; no weeds should be allowed to grow, and a good soil mulch should be maintained to stimulate a rapid growth. No other care is needed.

The tops will be ready for harvesting in midsummer. They should be gathered when the plants come into bloom. They may be used fresh or may be ground up and stored in tightly-stoppered bottles for winter use.

**52. Winter, or mountain, savory** is a hardy, shrubby, evergreen perennial, that is a native of Italy, and greatly resembles the annual plant, summer savory. It is common in European gardens. The plant grows to a height of 12 to 16 inches. The stems are woody, slender, and branching. The leaves are narrow and pointed, the flowers are pink and lilac, and the seeds are brown. The seeds will retain their power of germination for about 3 years, and are somewhat cheaper than those of summer savory; they can be produced in the same way as those of summer savory. There are no distinct varieties.

Winter savory is commonly propagated by means of seeds, which are sown in April or May in drills about 15 inches apart; the seedlings are then thinned to stand about 12 inches apart. Winter savory can be propagated also by means of slips, cuttings, and by a division of the root.

The care and harvesting is conducted the same as for thyme.

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#### SWEET BASIL

**53. Sweet basil** is the most widely cultivated of a number of plants belonging to the basil family. **Bush basil** is grown to a limited extent, and requires the same care. Sweet basil is a native of the East Indies and was introduced into England, whence it was brought to America about the middle of the 16th century.

Sweet basil is an annual branching plant that grows about 1 foot high, and has small leaves and white flowers. The tops are shown in Fig. 17. The leaves and blossoms are the useful

parts. These have a strong flavor of cloves, and are used for flavoring soups, meats, stews, and many other dishes where a flavor of cloves is required; French cooks use sweet basil very extensively. On account of their odor, small sprigs of sweet

basil are sometimes added to a bouquet of flowers. Bush basil makes a particularly attractive edging for beds.

The plant is hardy and will do well in any good garden soil, but does best in a rich, light soil. The plantings should be made in localities free from shade.

There are no specific varieties, most seed houses listing the plant simply as sweet basil. The seed is small and retails in pound lots for about \$1.50 a pound. Seed can be readily produced in any locality where the plants will do well. A few of the finest plants should

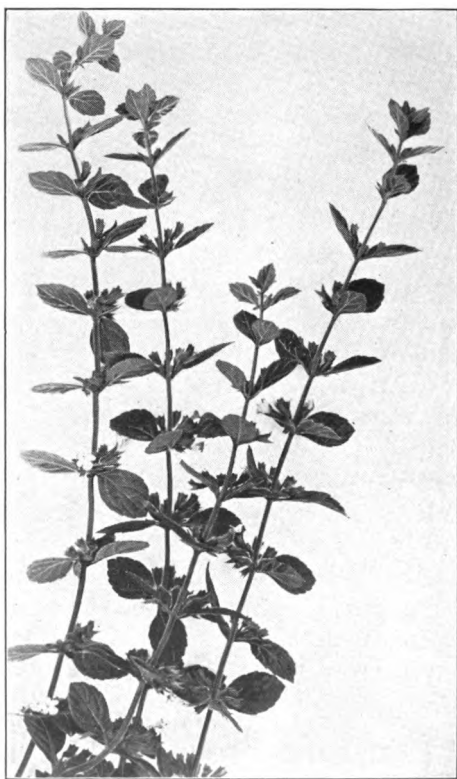


FIG. 17

be left uncut and allowed to develop seed. These should be gathered as soon as they ripen, dried, and stored in a dry place. When kept under good conditions they will retain their power of germination for about 6 years.

**54.** Sweet basil seed may be sown either under glass or in the open. If sown under glass it should be put in the bed early

in March and the plants set in the field as soon as the weather is settled. This is the best method of producing an early crop. The seeds are commonly broadcasted or sown closely in drills in a mildly-heated hotbed. As soon as the seedlings come up they should be thinned to stand about 1 inch apart in the drill. They should be transplanted once while still under glass. When the weather permits they should be set in the field or garden in rows 2 feet apart and 6 inches apart in the row. Sweet basil is usually difficult to transplant. The most successful method is to lift the plants with a good ball of earth attached and set them directly in moist soil. The plants should be well watered and shaded for a time until they become well established.

In the latitude of New York City, sweet basil seed may be sown in the open in April. It should not be sown too early, because the seed is likely to rot in the ground, and the young plants are rather delicate and may be injured by frost. The seed may be sown in borders in a garden, but in a field it should be sown in drills 2 feet apart and the plants thinned to stand about 6 inches apart after they reach a height of 2 to 3 inches. The seed should be covered shallowly, but the soil should be pressed down firmly on it. Some persons thin the seedlings in borders to stand 10 inches apart. The plants of the bush basil, because they are dwarfish, can be grown somewhat closer than those of the sweet basil.

Cultivation should be thorough enough to keep the weeds down and to maintain a mellow condition of the soil as long as the plants remain in the ground.

**55.** Sweet basil should be harvested just as the plants come into flower. Both the leaves and the flower stalks should be cut. If these are cut from 2 to 3 inches above the ground a second cutting may be made in the same season from early-set plants.

The foliage may be dried for winter use. For this purpose, the cut tops should be hung up in small bundles in the shade to dry. When thoroughly dried they may be powdered. If placed in tightly-stoppered bottles, this powder will keep for a long time.

## SWEET MARJORAM

**56.** **Sweet marjoram** is a biennial that is grown as an annual, because, unless the plants are carefully protected during the winter, they will be readily winter killed; by some it is called *annual majoram*, because it is grown as an annual. Sweet marjoram is closely related botanically to thyme; it is a native of

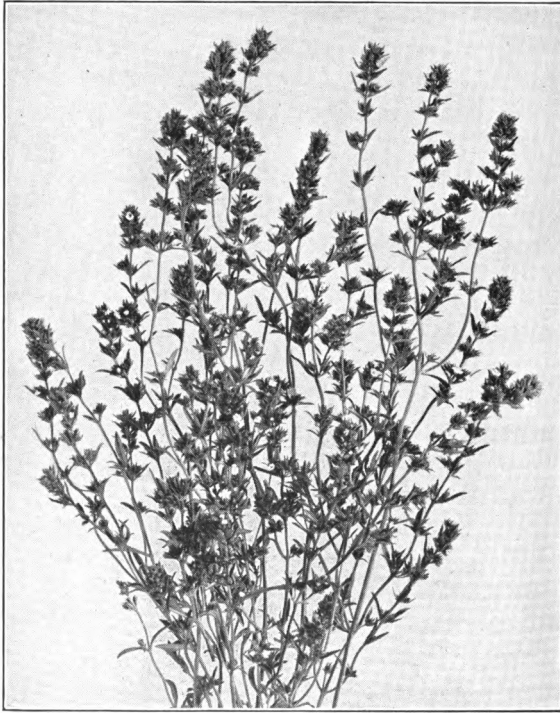


FIG. 18

Portugal and the Mediterranean section of Europe, and has been cultivated in England since the latter part of the 16th century.

Sweet marjoram grows erect and branching; the leaves are small, rounded, or oval, and grayish green; the flowers are small, borne in small, close heads, whitish, and appear in midsummer; the seeds are small and oval and of a dark-brown color. Tops

of the plant are shown in Fig. 18. The leaves have a pleasant odor, and a warm, aromatic, bitterish taste, due to a volatile oil they contain. The leaves and stems are used both green and dried for seasoning soups, stews, meat pies, dressings, etc. The volatile oil that is extracted from the plant is used in medicine as a tonic; it has also been used as a home remedy for many years to bring out a rash, as in measles; this oil is soluble in water.

The plant of sweet marjoram is tender, and, as previously mentioned, will not withstand the winter unless well protected. The seedlings are tender to late frosts in the spring. The soil should be light and somewhat dry, but should be fertile.

**57.** There are no varieties of sweet marjoram that are listed as such. American seedsmen rarely list the plant other than as sweet marjoram. The seed may be bought in pound lots for about \$1.50 a pound. It is very small. Most growers find that American-grown seed is superior to foreign-grown seed for the production of plants for tops to be dried for winter use; but they also find that the imported seed is more satisfactory for producing plants for cutting while green during the summer.

**58.** Sweet majoram is propagated by means of seed, but it is often difficult to get a good stand of plants, because the seed are small and the young seedlings are tender when exposed to the sun. The safest plan is to shade them somewhat during the heat of the day until the plants are well rooted. This can be conveniently done in a hotbed where a cloth screen can be laid over the glass at midday. Successive sowings are usually made if a continuous supply of plants is desired. The seedlings should not be transplanted to the open ground until all danger of frost is past; they are not usually set out until May or June.

After the soil warms up well and there is no more danger of frost, the seed may be sown in drills in the open. The seed should be sown shallow and covered lightly with very fine soil.

The rows for sweet marjoram should be from 10 to 12 inches apart, and the plants should stand about 6 inches apart.

Clean cultivation should be practiced throughout the season. Plants from seed sown in the field should be thinned to stand the proper distance apart before they crowd badly.

**59.** Harvesting can begin at any time the foliage shows enough growth. Plants grown in the hotbed and set out early in the spring will be ready for cutting early in the summer. The largest yield of the best foliage can be secured just before the plants begin to flower. This is the best time for cutting for winter use. The plant should be cut close to the ground and should be hung up in a cool, well-ventilated place to dry.

**60.** There is a fair demand for sweet marjoram in large city markets, particularly from foreigners from Southern Europe.

**61. Pot marjoram** is a perennial plant of the same family as sweet marjoram, and is a native of Sicily. It is commonly propagated by dividing the roots early in the spring; it may also be propagated by seed. The plants are not so delicate as those of sweet marjoram, but to induce a quick growth they should be set in a warm location. They should be planted in rows 15 inches apart and spaced 10 inches apart in the row. This vegetable meets with a light demand from Southern Europeans.

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### THYME

**62. Thyme** is extensively grown for an herb, being of almost equal importance with sage in this respect. The common thyme that is grown as a sweet herb is one of about fifty species or more. It is a native of Southern Europe, particularly Spain, Italy, and Greece. It was first recorded as being grown in England about the middle of the 16th century, and was probably brought to the United States from that country.

The thyme plant is a low-growing, spreading, evergreen, perennial. The branches are stiff and woody, the leaves are small, and the flowers, which are usually bluish or purplish, are borne in whorls forming a terminal spike, or head-like cluster. Thyme branches are shown in Fig. 19.

The young leaves and shoots are used for flavoring soups, dressings, sauces, etc. They have a pleasant aromatic odor, somewhat like mint, and a warm, pungent taste. The scientific name of the plant, *Thymus*, comes from the Greek word for

courage, because the ancients believed that when thyme was eaten it would renew the strength and spirits.

63. There are a number of varieties of thyme, including some broad-leaved and some narrow-leaved kinds, but most seedsmen list the herb simply as thyme. The seed is very small and retails in pound lots at from \$4 to \$5 a pound. When permitted to go to seed, the plants will produce large quantities.



FIG. 19

The spikes, or heads, should be cut as soon as they show signs of ripening and before a heavy rain washes the seed out. They should be hung up to dry over a cloth, preferably in the shade. After they are dried the seed can be easily shaken out.

64. The thyme plant, being an evergreen, is very hardy, and will stand the climate of all sections of the United States where there is sufficient moisture in the soil. The crop may be grown

in a great variety of soils, but the best results are secured on a light, well-drained soil.

**65.** Thyme may be propagated by seed, by cuttings, and by division of the roots. New beds are commonly started from seed, unless the roots can be secured from a near-by bed. The soil for the seed should be made very fine. The seed should be sown as early in the spring as the ground can be prepared; as the seedlings are hardy, they will not be injured by late frosts. The seeds should be sown in moist weather and should be well-watered immediately after being sown. They should be sown very shallow in drills about 6 inches apart; the surface earth should be pressed down firmly over them with a board. The seedlings also should be well watered. Some growers allow the seedlings to grow in the drills until they are 2 to 3 inches high and then transplant them in rows 18 to 20 inches apart and 6 inches apart in the row. Others simply thin the plants to 6 inches apart in the drills. A good plan is to do this and transplant the seedlings that are taken out in another bed.

When thyme seedlings are grown for transplanting, they do not have to be set in their permanent places until June or July. This allows time to grow an early crop on the land before the thyme is set out. This plan of starting a bed is popular because a larger income can be secured from the land the first year.

Pieces of thyme roots are often used to renew a bed. These are planted at the same distances as the transplanted seedlings. A larger crop the first year can be produced from root cuttings than from seed. Although thyme is a perennial, the abundance of the cuttings will diminish after two or three cuttings, and new beds should be set out every 2 or 3 years.

**66.** Cultivation of thyme should be thorough, and all weeds should be kept down, especially while the plants are young. When closely set, the plants will shade the ground during the latter part of the season and the weeds will be smothered out.

**67.** Thyme tops should not be cut down too low. Stubs about 2 to 3 inches long should be left. The evergreen nature of the plant makes it unnecessary to be hasty about the cutting.

# ASPARAGUS

(PART 1)

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## GENERAL REMARKS

1. **Asparagus**, although not long ago regarded only as a luxury, is now rapidly becoming one of the important vegetable crops. It is cultivated in nearly every country in the world, but is produced commercially in the largest quantities in France, Germany, Holland, England, and the United States. The white, or blanched, asparagus, which is preferred for canning, is grown largely in California and on Long Island for this purpose, and the green asparagus is grown in almost all parts of the country. The large quantities of asparagus grown in California are shipped principally to Eastern markets.

2. The increased demand for asparagus has been partly due to the fact that it is one of the first of the fresh, succulent vegetables that can be secured in the spring, and partly due to its own good qualities; because of the latter it is often recommended for the sick and convalescent. The length of time this vegetable can be found in the markets and the ease with which it may be prepared for the table are also factors that recommend it to a large number of persons. Outdoor-grown asparagus can now be obtained in the markets from the early part of March until far along in the summer, usually as late as August, and asparagus that is forced indoors can be obtained in varying quantities throughout the winter; canned, it may be secured at all times; hence, asparagus may now be considered to be an all-year-round vegetable. It is usually prepared for the table simply by boiling.

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3. From the viewpoint of the vegetable grower, asparagus is one of the two important perennial vegetables; rhubarb is the other; perennial crops of lesser importance are dock, sorrel, sea kale, globe artichoke, and Jerusalem artichoke. The perennial nature of asparagus, however, operates against its production on the highest-priced market-gardening land, and because of this fact it is usually grown extensively only in sections where, although the soil is particularly well adapted to its culture, the price of land is not exceptionally high. How much it is profitable to pay for land on which to grow asparagus cannot be stated offhand without a knowledge of local conditions. Not that asparagus will not pay a reasonable profit on high-priced land, but many intensive market vegetable growers prefer to utilize the land in crops that allow of several croppings in a season and thus return a greater combined profit.

4. Asparagus is so much different in its method of growth from most vegetables that it must be treated more like a small fruit or even like a tree fruit. The factors that affect the advisability of making asparagus one of the crops on a vegetable farm are: (1) The market; (2) the profit that can be obtained from this crop as compared with the profit from a succession of crops on the same land; (3) the character of the soil; (4) the supply of labor available for harvesting and preparing it for market; and (5) the ability of the grower to handle the crop.

5. **Hardiness.**—Asparagus is usually considered to be a tender plant and lacking in hardiness. This is because the young, marketable shoots are readily destroyed by frost. The plant itself, however, that is, the roots, will stand hard freezing, wintering over without injury in the most northern sections of the temperate zone where the frost enters the ground to the depth of several feet. Because asparagus is found growing in large quantities on low lands near rivers and other bodies of water, it has gained the reputation of thriving best only in such locations. The abundant growth of asparagus in such locations, however, is probably due more to the favorable soil conditions than to climatic influences. Such locations are

also often accessible to a large number of cheap laborers, and this is an important factor.

**6. Character of the Plant.**—The asparagus that is eaten as a vegetable is a plant of the genus *Asparagus*, which belongs to the lily family. This genus is a native of Europe and includes more than 100 species, some of which, as, for instance, the asparagus vine that is used in making bouquets of cut flowers and the smilax, are used for ornamental purposes. The edible asparagus, now consisting of several varieties, are of the one species, *Asparagus officinalis*.

The asparagus grown as a vegetable is a herbaceous plant that grows from a crown, or root stock, to a height of 4 to 7 feet and has a branching top. The top is annual—that is, lives for one season only—but the crown and roots are perennial—that is, live through many seasons. In Fig. 1 is shown a small asparagus plant as it would appear if dug up early in the spring just as the new shoots were beginning to come up. The crown, which consists of the thickened upper parts of the roots, is shown at *a*, and the buds are shown at *b*. The crown will normally make a new growth each year in a horizontal direction of from 1 to 3 inches, and will thus, after a number of years, cover a considerable area; shoots may be sent up from both ends of the crown or from one end only, but in either case the older part of the crown will eventually become unproductive and die.



FIG. 1

**7.** In a healthy, vigorous plant, the upper side of the new growth of the crown will contain a large number of buds *b*, and the older part of the crown will contain the scars formed by the removal of shoots and the dead stumps of old shoots *c*. On the

plant shown two of the buds from the newer part of the crown have sent up shoots, or spears, *d*, which are now at the proper stage for cutting for the table, but which, if allowed to grow undisturbed, will eventually produce tops bearing the leaves and seeds of the plant, shown in Fig. 2.

The storage roots *e* grow out from the lower part and from the sides of the crown. Healthy storage roots are light colored, are  $\frac{1}{8}$  to  $\frac{1}{4}$  inch in diameter, and commonly make a lateral growth of from 18 inches to 3 feet. When a lateral growth of 3 feet is made, the roots will form such a solid mat under the surface of the ground that plowing them out is almost impossible, and deep cultivation is made difficult. These storage roots have two functions: (1) They act as common roots—that is, they send simple plant-food from the soil to the upper parts of the plant and receive elaborated food in return; and (2) they have a special function of storing up food that has been elaborated by the tops, which stored food provides energy for the development of the shoots and tops of the plant the following spring. Sometimes, in commercial plantations, as much as 2 and even 3 pounds is cut from one asparagus plant, and when this large quantity is considered, it can readily be understood that large quantities of plant-food must be stored in the roots. The plant-food is supplied by a large number of feeding roots *f*.

8. A detailed view of part of the top of an asparagus plant is shown in Fig. 2 (*a*). Such tops are produced from the shoots, or stalks, shown at *d* in Fig. 1, and, as previously mentioned, they grow to a height of several feet, sometimes as high as 7 feet and even higher. The stems, the elongation of shoots, or stalks, are shown at *a*; the leaves which look somewhat like pine needles, are shown at *b*; the flowers are shown at *c*; and the berries, in which the seed are borne, are shown at *d*. In (*b*) is shown a flower enlarged. In (*c*) is shown the cross-section of the three types of asparagus flowers; *a* is a female, or pistillate, flower; *b* is a male, or staminate, flower; and *c* is a hermaphrodite, or bisexual flower, having both sets of reproductive organs.

**9. Longevity of Asparagus.**—Asparagus is a long-lived plant, and asparagus beds more than 50 years old are in exist-

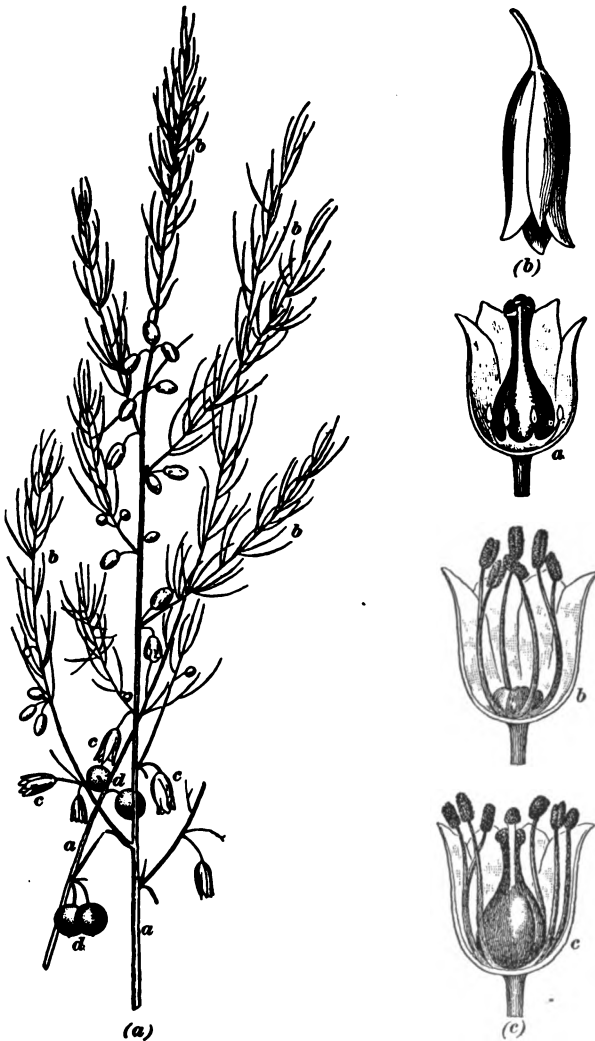


FIG. 2

ence. Very commonly, beds 20, 25, and more years old are found producing crops regularly. Although this is possible,

the average profitable commercial life of an asparagus bed is much shorter, because after the plants are from 8 to 10 years old the size of the shoots produced are smaller than those most in demand in the market, and hence the income from an old bed is much less than from one where the large stalks will command the highest prices.

The exact number of years a commercial grower can expect to harvest crops from an asparagus bed will depend on the locality, on soil conditions, and on the management. The treatment given to the bed in the first few years is a very important factor, and the method of cutting also has a great influence. A continuance of the cutting season beyond the dates mentioned elsewhere means a greater tax on the stored-up food in the roots than can be withstood. A certain length of time is necessary for the growth of the tops in order to restock the root system with food enough to produce the crop of the following spring. The ill effects of cutting shoots beyond a certain time cannot be overcome by any known method of treatment; excessive feeding with manures and fertilizers will not entirely supply the deficiency, although, of course, it will help.

**10.** In the ordinary commercial plantation the diminution in size of the stalks is such that many growers discontinue the bed after it is 10 years old; most growers discontinue the bed by the time it is 12 years old; and the extreme limit of profitable production is probably about 15 years.

An asparagus bed does not normally produce a crop the first or the second year and perhaps only half a crop the third year, so that a bed to be discontinued at 10 years of age can be counted on to produce seven full crops and one partial crop. Hence, to arrive at the actual profit on this the cost of production must be figured for 10 years.

**11. Commercial Importance.**—The total value of the asparagus crop in the United States in 1909 was \$2,246,631, and this crop was raised on 25,639 acres distributed among 5,300 farms; this crop was based only on patches of 1 acre or more, and does not include the great quantities that were grown

in smaller areas, as in home gardens. During the 10 years between the census of 1900 and the census of 1910, the area in asparagus in the country increased more than 250 per cent. According to the 1910 census, the total value of the asparagus crop was about 57 per cent. of that of the celery crop, and about 80 per cent. as large as that of the green bean crop.

**12.** Asparagus is extensively grown in the United States, only four states, Idaho, Maine, Montana, and Wyoming reporting no farms raising 1 acre or more. The ten states of most importance in the raising of asparagus, named in order according to the value of the crop produced in 1909, are: New Jersey, California, Illinois, Pennsylvania, South Carolina, New York, Massachusetts, Maryland, Ohio, and Delaware; the production in each of the last three, however, was much less than that of Massachusetts. Between them, these ten states produced nearly 85 per cent. of the total crop of the country, and the first two, New Jersey and California, produced about 47 per cent. of the total crop.

**13.** According to the census of the crop of 1909, the average income per acre from asparagus in the United States was about \$88, the average number of acres planted per farm was about 4.84, and the average income per farm was a little more than \$424. The average income per acre in Massachusetts was about \$150; in Pennsylvania, \$147; in Ohio, \$130; in New York, \$127; in New Jersey, \$117; in Delaware, \$90; in Illinois, \$81; in South Carolina, \$78; in Maryland, \$77; and in California, \$48. Most progressive growers, however, would consider these figures on income very small.

**14. Cost of Production.**—The cost of production of 1 acre of asparagus up to the time when it may be cut varies with the management, the value of the land, the quantity and value of manure and fertilizer used, the cost of labor, the method of securing plants for setting, etc. Some growers estimate that it costs from \$75 to \$125 an acre to bring an asparagus bed in good condition to cutting stage in the spring of the third year. One New England grower estimates the

annual cost of production on his asparagus bed at from \$100 to \$150 an acre, exclusive of the cost of marketing, itemized as follows:

Manure and fertilizer.....	\$50 to \$75	
Disking and harrowing in the spring.....	4	4
Twelve cultivations.....	12	18
Cutting.....	25	40
Tying.....	9	15
	<u>\$100</u>	<u>\$150</u>

15. The cost of asparagus plants for setting should not exceed \$4 a thousand if the plants have to be bought and they can be raised for one-half that amount. The cost of establishing a bed can be reduced somewhat by intercropping the first year, but unless this is carefully done the bed may be injured more than the value of the crop secured from the land between the rows.

16. **Yield and Income per Acre.**—As might be expected, the yields and returns from asparagus vary widely. The yield is dependent on the local soil and climatic conditions and on the management, and the returns from the sale of the crop depend a great deal on the salesmanship of the grower, and the time of marketing, the early crop selling for the higher prices. For this reason the prospective yield or income from any particular asparagus plantation is difficult to forecast. The best that can be done is to give the results that have been secured in various instances. A good annual yield for a skilful grower is generally considered to be about 2,000 bunches that average from 2 to 2½ pounds each, or a little over 2 tons, to the acre. Such a yield, however, is much above the average for the country. Some intensive growers will occasionally get more than 3,000 bunches of the above size per acre, but the extensive grower that is able to make his beds average 2,500 bunches per acre for seven crops is getting a remarkable yield.

17. An average gross return of about \$250 per acre is considered by most skilful growers to yield a fair profit, and perhaps even a little more. Many, of course, do not obtain this

much gross income from an acre. Incomes of as much as \$500 per acre for plantations as large as 10 acres have been secured in a single season, though there are no records to show that such an income has been secured as an average for any considerable number of years.

18. The income per acre naturally depends largely on the price secured for the product. Early in the season a price of \$10 or \$12 per dozen bunches can sometimes be secured for limited quantities of extra-quality asparagus, but throughout the season the prices will range from \$1.50 to \$4 per dozen bunches. If a net average of from \$2.25 to \$2.50 per dozen bunches can be secured, after deducting expenses, such as transportation and commissions, the returns per acre should be very satisfactory for the grower who can produce 2,000 bunches or better per acre.

19. **Green Versus White Asparagus.**—In some markets and for some purposes, notably canning, white asparagus is preferred to green asparagus and brings higher prices. White shoots may be grown from any variety either by setting the plants deep or by ridging the rows. This causes the growth of a considerable part of the shoots under ground, thus blanching, or bleaching, them. Green shoots are produced in the light. If the price paid for white asparagus is enough higher than that paid for green asparagus to make the net profit greater, all other sides of the question are unimportant to the commercial grower. He should and probably will produce white asparagus for market even if he raises some of the green for his own table. It is usually much more profitable to supply a demand in a market than it is to attempt to educate a market up to a product that it is unaccustomed to and perhaps does not even want.

The question of whether green or white asparagus should be grown is, however, a topic that has called forth much discussion. The following points on both sides are presented to give a basis for the formation of individual opinions:

1. One fundamental point should always be borne in mind when considering this question. It costs more per bunch to produce white asparagus than it does to produce green asparagus. Hence, when both kinds must be sold at the same price, the

business of white asparagus growing is not attractive. The production of white asparagus involves somewhat more work in planting, general care, and cutting, and as the rows cannot be planted as close as those for green asparagus, the land is not as economically employed. In the first place, the plants need to be set from 2 to 4 inches deeper than the roots for the production of green asparagus, and, in the second place, the rows need to be ridged or rounded higher during the cutting season. Both of these items require extra work. The shoots of the white asparagus must be cut when only 2 or 3 inches above the surface. This means that to secure a shoot of marketable length, the shoot must be cut from 6 to 8 inches below the surface. This cutting requires more labor and more skill, both to cut the shoot and to avoid injury to the buds on the crown—a very important point, as injured buds will mean just so many less shoots. Slight soiling of white asparagus shows more than slight soiling on the green. This necessitates more careful handling of white asparagus in the packing shed. Otherwise, the cost of production of the two kinds of asparagus would not vary much.

2. Many arguments for and against the planting of green or of white asparagus are based on the superior flavor of the one as compared with the inferior flavor of the other. By different persons the flavor of the white asparagus has been described as being "decidedly milder," and that of the green asparagus as being "much more delicate." Any matter that depends on the sense of taste for decision must necessarily have champions on both sides, and hence any opinion given here might readily be regarded as being a personal opinion. The fact, however, that the acreage and production of green asparagus is larger than those of the white and is rapidly increasing in the United States would seem to indicate that in this country, at least, a majority of persons prefer the green to the white asparagus.

3. The green asparagus can be grown in so many soils that the statement is often made that it can be grown in any soil; this statement could be accepted as a fact if it were qualified by the words "where ordinary farm crops will do well." High-grade white asparagus can be grown in a sandy soil only,

because any stains that a heavy soil would make on the shoots would injure their market value.

4. Asparagus shoots diminish in size as soon as they leave the ground. For this reason more green asparagus shoots are required to make a bunch of the same diameter as white shoots. This difficulty may be partly overcome by breeding, and proper seed and plant selection.

5. As little soil is needed for ridging green asparagus, in some cases none, the rows can be planted closer than for white asparagus. This, of course, will give more plants to the acre and the possibility of securing a yield of a larger number of stalks, thus overcoming to some extent the disadvantage of the smaller-sized stalks.

6. The demand for green asparagus is growing rapidly and the price averages somewhat higher than for white asparagus in a large number of markets. In cases where this is true, it will also aid in overcoming part of the disadvantage due to the smaller stalks.

7. The control of the asparagus beetle on the green asparagus is much more difficult than it is on the white asparagus, because the shoots are more exposed to the ravages of this insect. Proper methods of culture, will, however, reduce this disadvantage.

**20. Soil for Asparagus.**—Asparagus will do well on a great variety of soils, but seems to be best adapted for growth on a sandy loam soil that is free from stones. The great adaptability of asparagus to different soil conditions is of importance to many growers who may not have a sandy loam soil available but who can find a ready market for the crop. Shoots of the largest size are produced on sandy soils that are mixed with peat, such as are found in the great asparagus-growing sections in Orange County, California.

An abundant water supply is of first importance to asparagus and hence, to be ideal for growing this crop, a soil should be supplied with a great deal of water and be well-drained. On some well-drained soils where the water-table is but a few feet below the surface, asparagus will grow to its fullest perfection. It will not thrive in a wet, soggy soil, however.

For the growing of white, or blanched, asparagus a sandy soil is essential, because cutting under ground, ridging, and producing straight shoots are difficult in a heavy clay soil.

Stones in a soil are a serious drawback to the production of straight, attractive shoots. They interfere also with the culture of the crop and are in the way at harvesting time.

21. Some authorities claim that, since asparagus is a surface feeder, its roots running out from the center of the plant nearly horizontally in all directions, the character of the soil below a depth of 18 inches is of little importance. This may be true so far as the amount of available plant-food is concerned, but the water-holding capacity of the lower part of the soil and the ease with which it drains are factors of the utmost importance.

22. Southeastern, southern, and southwestern exposures are to be preferred for asparagus, because it will start into growth sooner in warm locations, and the best prices are secured early in the season. The least desirable location is on a northern slope.

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## VARIETIES AND NURSERY STOCK

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### VARIETIES

23. There are fewer varieties of asparagus than of most vegetable crops, and the distinction between varieties is not striking as in the case of some plants. In all probability the strain of seed selected for the production of nursery plants has more to do with the success of a plantation than the variety. If the seed has been carefully selected from a strong-growing, large-stalked strain of asparagus the results will be good. The three leading varieties of asparagus are *Argenteuil*, *Conover's Colossal*, and *Palmetto*.

24. The *Argenteuil* asparagus can be particularly recommended because of its rust-resisting qualities; this variety is now probably being more largely planted in the United States than any other. The *Argenteuil* originated in France and is

grown in large quantities in the vicinity of Paris, where it is noted for its large stalks and fine flavor; it was imported from France into the United States at a comparatively recent date.

**25.** The **Conover's Colossal** asparagus is a variety said to have originated on Long Island about 1880. At that time it was distinctly superior to the other varieties that were being planted and has held its own surprisingly well. Good strains of this variety are strong growing and produce large shoots. The shoots are somewhat lighter in color than those of **Argenteuil** and **Palmetto**. The rust-resisting qualities of **Conover's Colossal**, however, seem to be less than those of **Argenteuil**, and for this reason **Argenteuil** is largely superseding it for present-day planting.

**26.** The **Palmetto** asparagus is said to have originated in the South, but it has been more widely advertised than any other variety and hence more extensively planted; it is usually considered the leading American variety. Some authorities claim that the quality of the shoots of this variety is not as high as that of some others, but this characteristic is varied considerably by methods of production. Some difficulty is experienced in distinguishing between **Palmetto** and **Argenteuil**. Some observing growers have gone so far as to call them identical. At any rate, they closely resemble each other, and **Palmetto**, like **Argenteuil**, seems to possess considerable rust-resisting quality. The shoots of both of these varieties have purplish tips and the entire head of the shoots are of a darker purplish green than the shoots of most of the other varieties.

**27.** The **Barr's Mammoth**, the **Moore's Cross-bred**, the **Columbian Mammoth White**, and the **Donald's Elmira** asparagus are varieties of good quality, but they are not as extensively planted as those previously described.

**28.** The **German Giant** and the **Yellow Burgundy** asparagus are varieties grown in Europe to a great extent, in addition to some of those previously mentioned. The **Holland**, **English**, and most of the French and American varieties of asparagus have been derived from the **German Giant**.

## NURSERY STOCK

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### PROPAGATION

29. The proper starting of an asparagus bed is a very important part of the work of asparagus culture, because on the skill and thoroughness with which such work is conducted depends, to a great extent, the future productiveness of the bed. After the site for the bed has been selected, the next most important thing to consider is the securing of the plants for setting in it. These may be purchased from seedsmen or may be grown at home from seed.

The amateur gardener commonly buys his asparagus plants from a seedsman, usually purchasing 2-year-old plants, but for the commercial asparagus grower such a practice is unwise for three reasons: (1) the cost of the plants is too high; (2) the quality and character of the stock from which they were produced is unknown; and (3) a 2-year-old plant is not the best type of plant for starting an asparagus bed that is expected to yield a profit. The commercial grower should always produce his own asparagus roots from seed.

30. The first consideration is to secure seed of the highest quality. Preferably, of course, the seed should be selected by the grower himself from plants of known quality, but if this is not possible the seed should be purchased from the best possible source.

The variety best suited to the local conditions should be selected. This information can usually best be obtained from the growers in the neighborhood, or from the state agricultural experiment station. Ordinarily, the variety that will do the best in any neighborhood will be the one that will grow the largest stalks and that will be most resistant to rust.

After the variety has been selected, the seed should be selected. Seed selection among asparagus growers has been practiced for many hundreds of years, and even the ancients appreciated the value of selecting seeds that would produce plants bearing large stalks. Many growers consider that the

selection of seed is an even more important a part of asparagus culture than careful tillage and heavy, systematic fertilization.

### **31. Handling of Plants for Seed Production.**

Because asparagus is propagated only from seed and the tendency to revert to other and inferior forms is thus always present, great care should be exercised in selecting the plants for the production of seed. Only those having in the highest degree the qualities most desired should be selected. Most commonly plants are selected because: (1) they bear the largest stalks of uniform size; (2) they produce stalks of the best quality; (3) they bear few seeds or none at all, since the production of seed is exhaustive and plants that produce seed do not store up as much nourishment in the roots for the production of shoots the following spring as those that bear no seed; (4) they are vigorous and productive of large numbers of attractive stalks; (5) they are resistant to disease; (6) they have a closely-built, solid terminal bud so that the sprouting of lateral branches is delayed until the shoot reaches a height above the usual cutting stage; and (7) they produce a large proportion of their stalks early in the season. When the shoots are to be produced for market, the last consideration is of first importance, but where the shoots are to be produced for the canning factory, this is not so important a factor as the others.

Seeds for the production of asparagus roots for planting should be taken from mature plants only, that is, from plants that are 4 years old or older; many growers prefer to take such seed from plants even much older than 4 years, holding that such seed will produce the best results.

**32.** The plants from which seed are to be selected should be kept under observation for at least one season, or preferably for several seasons. Those which most closely approach the ideal desired by the grower should be selected. The most certain way of determining the productiveness of an asparagus plant is to weigh all the cuttings for one or more seasons, although this necessarily entails a great deal of detail work, and few growers are willing to do the work.

**33.** When handling asparagus plants for the production of high-class seed, care should be taken to see that in the selection for quality that the sex of the plants is not overlooked. Asparagus plants are largely of two kinds, those that bear male blossoms and those that bear female blossoms; some few plants will have more or less perfect flowers. To be successful in the production of high-grade seed, high-grade plants of both sexes must be selected and these must be located close together, for the pollen from the male plants is not commonly carried far. One male plant will give sufficient pollen to fertilize the blossoms of several female plants, provided the female plants are close enough. No male plants, except the selected male plants, should be allowed to bear blossoms within a considerable distance of the selected female plants, for if the pollen from undesirable male plants fertilizes any of the blossoms the results will not be satisfactory.

**34.** The selection of plants from which seed is to be secured should be done during the summer and the plants marked with stakes so that identification will be easy the following spring. The other plants in the field should have their shoots cut off and marketed in the usual way. All shoots on the breeding plants, except from two to four according to the vigor of the plant, should be pinched off, and those that remain should be allowed to grow at will. Handled in this way, the few shoots remaining on each plant should grow to large size and produce large, heavy seed. After the asparagus stalks have grown to  $3\frac{1}{2}$  to 4 feet in height, from 6 to 8 inches should be clipped off the top and the tips of the side branches should be pinched off to stimulate the production of larger and better seed lower down on the plant. The plant should not be permitted to bear an excessive number of seed berries; in case too many set, a number of those near the extremities of the plant should be taken off.

**35. Treatment of Seed After Harvesting.**—Asparagus seed should be allowed thoroughly to mature on the stalks. The berries should then be carefully stripped by hand from the stalks and soaked in water for a day or two. As soon as the

shells and pulp have become sufficiently softened, they should be removed from the seed by rubbing the berries between the hands. The seed should then be washed, dried, and stored in a dry place. The heavier seeds are to a considerable extent separated from the lighter ones during the process of washing, the heavier seeds sinking to the bottom and the lighter seed floating with the berry shells and pulp. If desired, the seed may be further graded by running them over screens of the desired mesh.

When seed is grown commercially it is seldom handled as carefully as just described. The plants are usually cut in the fall when convenient, hung up to dry for a few days, and then the berries threshed off. The berries are soaked in water for a couple of days and then rubbed, sometimes none too carefully, with a wooden block on a table, to separate the seed from the pulp. Sometimes the heavy seed are separated from the light seed, but more often little attention is paid to this.

**36. Purchasing of Seed.**—When seed must be purchased, they should be secured from growers of experience or from reliable seed houses. A sample of first-class seed actual size is shown in Fig. 3. These seeds are plump, heavy, and even in size. As a general rule, none but the highest-priced seed should be considered, as too much depends on the quality of the seed to warrant the taking of any chances. Asparagus seed will be found advertised for sale at from 50 cents to \$5 a pound. The demand for seed at the latter price is greater than the supply, partly because great quantities of it are not produced and partly because there is a constantly increasing number of growers who more and more appreciate the value of the finest seed.

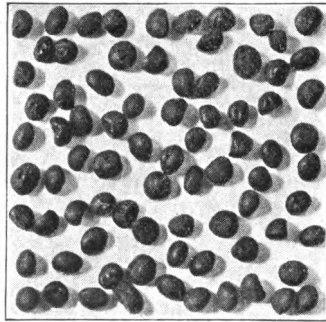


FIG. 3

The cost of seed is too small an item to cut any material figure in the cost of establishing an asparagus bed. About 3 to

5 pounds of the finest quality of seed should grow several times enough roots to set an acre, and it is certain that it would take a much larger quantity of 50-cent seed to produce even enough inferior plants to set an acre; but, granting that 3 pounds of 50-cent seed and 3 pounds of \$5 seed would both produce enough plants to set an acre, the \$13.50 saved in the purchase of the 50-cent seed would be a very small item compared with the far greater returns that could be expected from the plants grown from the better seed. Many growers consider that as little as 1 pound of high-grade asparagus seed should be sufficient to grow about 5,000 good plants, or nearly enough to set 1 acre; on this basis, the saving per acre would be only \$4.50. High price, however, should never be taken as an absolute gauge of quality. The reputation of the person or firm offering the seed should also be taken into consideration.

**37.** In handling asparagus seed, it is convenient to know that 1 quart of seed weighs about 32 ounces and that there are about 1,500 seeds in an ounce, or 24,000 in a pound, or 48,000 in a quart. Usually, about 5 pounds of seed will plant 1 acre and about 2 ounces of seed will be sufficient for planting 100 feet of drill.

Asparagus seed is fairly a long-lived seed. The average period of satisfactory germination is about 3 years, with an extreme limit of more than 10 years. Asparagus seed requires from 10 to 14 days to germinate. To be considered high-grade, asparagus seed should be about 99 per cent. pure, and about 85 per cent. of the seed should germinate.

**38. Outdoor Production of Plants From Seed.**—After the purchase of the seed, at the rate of 3 pounds or more of the finest seed for each acre to be set, a seed-bed for planting the seed should be selected. The soil in this bed should be a very fertile, light loam, in a high state of tillage—the richer and more friable the soil the better.

The seed should be sown as early in the spring as possible. In the latitude of New York the most favorable time is usually between April 15 and May 15. Early planting is essential, because asparagus seed is slow to germinate, and unless the

seed is planted early the young plants will not get the benefit of a long growing season the first year.

**39.** The distance apart for planting rows of asparagus seed varies with the method of cultivation followed. Where the area for planting is limited, the usual space between the rows is from 15 to 18 inches, and cultivation is done by hand with the common hoe or with the hand-wheel hoe. The rows must be planted about 30 inches apart if horse cultivation is to be practiced.

Two plans are followed in the spacing of asparagus seed in the rows. Some growers plant the seed about two or three to the inch and then thin them to stand from 2 to 3 inches apart in the rows after they have grown to a height of a few inches. Other growers plant with special seed drills the shape and size of the seed enabling good work to be done with such a machine, and space the seeds about 2 inches apart and even as far as 3 inches apart. When a fine quality of seed is used this wider spacing is advisable, because the vitality of asparagus seed is high and the possibilities of an even stand are good. No matter how the seed is planted, however, the plants should be thinned to stand about 2 inches apart in the rows, or, even better, 3 inches apart. At these distances plenty of room will be allowed for growth and the most vigorous crowns will be developed. Failure to thin after close planting will result in the production of weak, spindling plants.

Asparagus seed should not be planted deeper than 1 to 1½ inches, as the young seedlings do not push out with much vigor. The sowing of a few radish or lettuce seed in the rows to mark them is a common practice and an aid in early cultivation.

**40.** Tillage should commence a few days after planting the seed. If radishes have been planted with the asparagus seed, their green tops will show above ground and will serve as a guide for the rows. The radishes should be pulled as soon as they reach a fair size in order not to interfere with the growth of the other plants; they should not be allowed to remain in the rows more than 4 weeks, and hence small, round radishes are

best to use. Tillage should be given every few days; it is not possible to overdo in this respect, provided none of the plants are uprooted or damaged during the work.

41. By the end of the growing season, properly-grown nursery plants should have tops 12 to 15 inches tall, from two to four stalks, and well-developed crowns. If the asparagus beetle makes its appearance, the plants should be sprayed with arsenate of lead, as described later, or with some similar poison. Plants intended for planting at home may be left in the ground over winter and be dug the following spring, when they may be

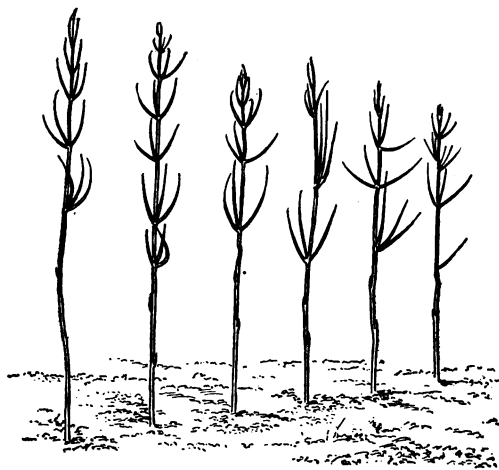


FIG. 4

transplanted direct to their permanent location. Plants that are intended for sale are usually dug in the fall and stored so that they may be ready for shipment in the spring as soon as they are wanted. Fall digging is also usually more convenient, as time is not so valuable at this season as in the spring.

42. To store asparagus roots, pack them in a vegetable pit or cool cellar and cover them with sand. Packed in this way they will keep plump and can be sorted and handled at any time that is convenient.

**43. Production of Plants in a Greenhouse.**—In order to overcome the disadvantages connected with the slow germination of asparagus seed, the plants may be started in a greenhouse or in a hotbed. In such a case, the seed and plants are handled in very much the same way as tomato seed and plants. The seed are sown in flats, the young plants potted in small pots when about 3 inches high, and later repotted in larger pots before being set in the nursery row. As in the case of other vegetables handled in a similar way, this method of growing asparagus plants secures strong, vigorous plants early in the season. If properly handled, plants several inches high may be secured for setting in the open at the time when seed are usually planted. Such plants thus have the full season for growth. The chief advantage secured from this practice is that a considerably larger number of shoots is obtained during the first few years of the plantation than would otherwise be produced. In this way the extra cost of producing such plants can be made up several times over.

Asparagus seedlings are shown in actual size in Fig. 4.

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#### SELECTION OF NURSERY PLANTS

**44.** Before setting asparagus plants in their permanent places in a plantation, the seedlings should be carefully selected and none but the very best used. One of the big advantages of the home growing of asparagus plants from seed is that a large number of good plants can thus be cheaply produced, and the number to be selected from may be large. When plants are bought the tendency is to set them all, because it seems a waste of money to discard any. Although this is perfectly natural, it is a short-sighted policy and productive of poor results. None but the very best plants should be set, regardless of cost, for the results will more than repay any extra expenditure at setting time. The necessity of growing a large number of plants is emphasized when it is considered that some growers discard and sell to others more than three-fourths of all plants grown, and keep only the pick of the lot for their own use.

45. When they are grown in a greenhouse, much of the work of selection can be done to advantage at the time of repotting the young seedlings, and thus time is saved that might be wasted in growing to maturity a number of plants that will in the end prove undesirable for planting. At this young stage, the plants can be very readily examined and a critical selection at this time is valuable. A great variation in the characteristics of the seedlings will be noted. The seedlings that will produce the best plants when mature will be those that have straight, smooth, cylindrical stems, that are free from any corrugations or irregularities, and that have shot up into growth rapidly and attained a height of 2 inches or more before the leaves were developed. The stalks should be thick and fleshy and fairly numerous. Nursery plants having stalks that put out leaves close to the ground should not be selected for planting, because they will develop into plants that will grow tough, stringy stalks when mature.

46. For commercial plantings 1-year-old asparagus plants are far more preferable than 2-year-old plants, because they receive less mutilation in transplanting and adapt themselves to their new surroundings more quickly. Careful experiments to determine the comparative value of 1-, 2-, and 3-year-old plants have indicated that 1-year-old plants in their third year from transplanting will give twice as large a crop as the 2-year-old plants, and three times as large a crop as 3-year-old plants transplanted the same length of time. These experiments were not extensive enough to warrant the statement that such a large difference in yield would always result so favorably to the 1-year-old plants, but still the evidence was conclusive that 1-year-old plants are superior to older roots for transplanting.

Seedsmen who cater to amateur gardeners usually make a specialty of 2-year-old plants, because such persons are anxious to secure big returns the first year or two and do not appreciate the greater value of the 1-year-old plants over the 2-year-old plants for a long period of time. Any asparagus grower who desires to bid for the amateur-gardener trade will doubtless find it most profitable to conform to the custom of selling

only 2-year-old plants unless he can explain the matter personally to his customers.

47. Perhaps, for the sale of most asparagus plants to the amateur-gardener trade, a better method than grading them

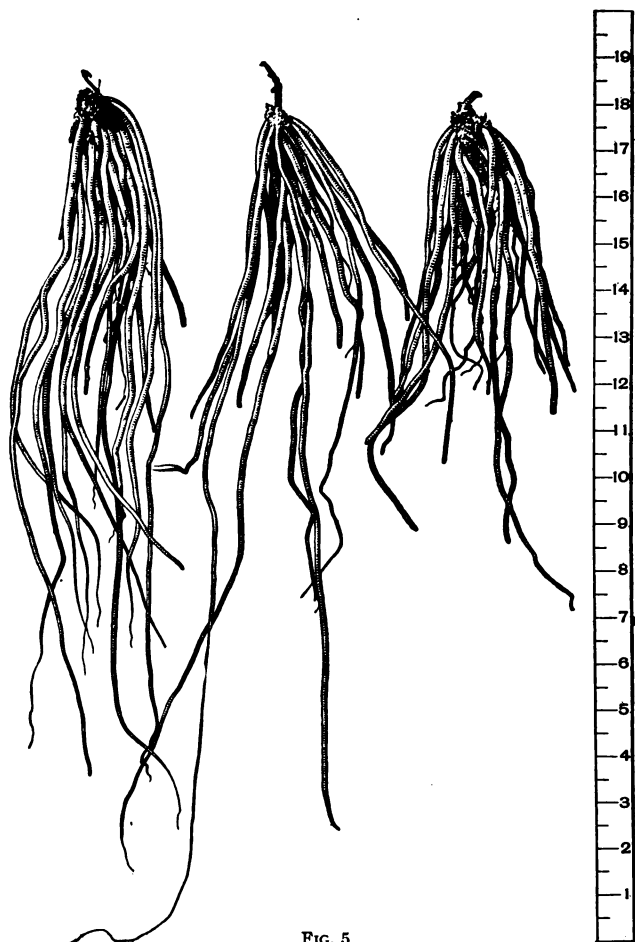


FIG. 5

by age would be to grade them according to size. A No. 1 grade could then consist of plants such as shown in Fig. 5 that have roots 12 to 16 inches long and four or five good buds in the

crown; a No. 2 grade could consist of plants with roots 9 to 12 inches long and three or four good buds; and a No. 3 grade might be made of plants that have roots less than 9 inches long and two or three good buds. The difference in price would then be based on the difference in size, and most persons could appreciate that argument better than the age argument. Plants that did not grow as large as desired might be transplanted and grown another year before being offered for sale.



FIG. 6

48. Any asparagus nursery plants having several small buds in the crown should never be planted in a commercial bed; it is much more economical in the long run to throw these away and buy new ones. Such plants will produce only small shoots from the small buds, and will continue to do so throughout the life of the plant, and small shoots bring low prices.

49. Experiments have shown that male plants are from 50 to 75 per cent. more productive than female plants, and that they also yield a larger number of shoots early in the season when the market prices are highest. For this reason, the

recommendation has been made that only male plants be set in a commercial plantation. The one big difficulty in the way of carrying out this suggestion, however, is the fact that asparagus plants do not blossom until the second season of growth, and the time considered best for transplanting is when the plants are 1-year-old. Possibly the plan of setting only 2-year-old



FIG. 7

male plants, which are old enough to indicate the seed-bearing habit, or of transplanting plants twice and setting male plants only in the commercial bed, might be worked out to the profit of a grower who would give the proper attention to details.

50. Specimens of asparagus nursery plants as they come from the seedsman are shown in Figs. 5, 6, 7, and 8. The plants shown in Fig. 5 are 2-year-old Palmettos of the best quality;

those shown in Fig. 6 are 1-year-old Palmettos also of the best quality; the scales in inches by the side of these plants give an idea of their size; the roots are plump and the crowns are full. The plants shown in Fig. 7 are 2-year-old Conover's Colossal, and those in Fig. 8 are 1-year-old plants of the same variety, the plants of both ages likewise being of the best quality. It will be seen that there is a slight difference in the appearance of the roots of these two varieties, but the difference is very slight

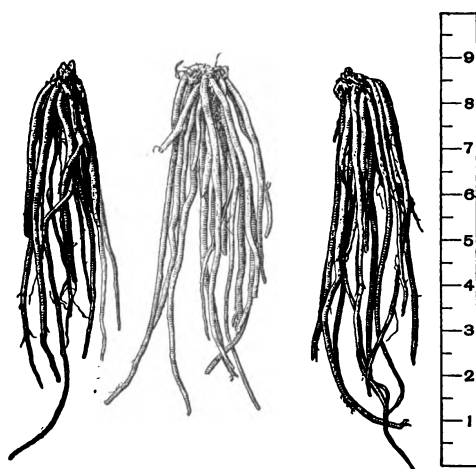


FIG. 8

and only an expert could, with certainty, distinguish between the two. These are shown to emphasize the fact that all asparagus roots of about the same size are similar in appearance, and that the nurseryman's word must be taken for a great deal; hence, the importance of dealing only with reliable nurserymen. Four

cull asparagus plants are shown in Fig. 9; the scale shows their size. Their general appearance is much less prepossessing than that of the good-quality plants.

51. In picking out the best plants in a lot secured from a nurseryman, certain means may be used to identify the plants that are most likely to do well after planting; these same suggestions will be useful for selecting home-grown plants. A good 1-year-old plant, such as shown in Fig. 6, should have a well-developed crown with three to five buds of good size, the best of which will measure about  $\frac{1}{4}$  inch in diameter at the base. The roots should extend from 6 to 8 inches in all directions from the crown, making a total spread over all of 12 to 16 inches. The roots should be plump, light colored, and should

"look alive." A good 2-year-old plant, such as shown in Fig. 5, should have two or three more buds in the crown than



FIG. 9

a 1-year-old plant, and the roots should be about one-third greater in diameter and about one-half longer.

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## PLANTING, CULTIVATION, AND GENERAL CARE

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### PLANTING

**52. Time and Distance for Setting.**—Asparagus plants should be set early in the spring, and the earlier the better the growth for that year—an important point the first season. In the latitude of New York any time from April 15 to May 1 will be suitable for planting. The time for planting in other parts of the country will vary accordingly.

When the asparagus bed is to be made a permanent plantation—that is, it is to last for 10 years or more—the plants should be set in rows 4 feet apart and the plants spaced 2 feet apart in the rows. Because of lack of room for development, closer planting than this will cause an early deterioration of the bed. Some growers plant the rows 3 feet apart.

Asparagus will not with certainty yield a full crop until the third year from the setting of the plants. Cutting any large quantity of shoots from the plants before the third year will be certain to result in injury.

**53. Preparation of Soil.**—The preparation of the soil in a field that is to be planted with asparagus should begin at least 1 year before the plants are to be put in, and if the land is poor the preparation should start 2 or even more years before. This does not mean that no crops should be taken from the land during that time, but rather that the crop or crops raised should be such that their culture will improve the soil for the asparagus. Asparagus is a heavy feeder and, as large quantities of plant-food are essential, the liberal fertilization of the crops taken from the land is advisable. The land should also be well supplied with humus, either from stable manure or from some form of green manure. As far as possible, the land should be free from stones or other materials that would interfere with the growth of straight stalks.

**54. Crops that are suitable for preceding asparagus** are sweet corn, snap beans, and similar crops that do well on light land. These crops should be well manured and fertilized with a commercial mixture that will provide large quantities of phosphoric acid and potash. An application the previous year of 10 to 15 tons of manure to the acre and about 1,000 pounds of a fertilizer analyzing about 3 per cent. nitrogen, 8 per cent. available phosphoric acid, and 8 per cent. actual potash will usually be sufficient.

If the soil is acid it should also receive an application of lime, usually about 2,000 pounds of air-slaked lime or its equivalent per acre. Thorough tillage combined with such an application of plant-food should put any suitable soil in good condition for asparagus.

**55. Marking Out the Land.**—In marking out the land for asparagus, the depth and direction of the furrows are matters of importance and should be given careful attention.

56. The depth of planting and, consequently, the depth of making the furrows for the rows depends on whether the product is to be sold green or white. When the shoots are to be sold green, the furrows should be plowed out so that the crowns of the plants, when set, will be from 5 to 6 inches below the ground level. When the shoots are to be sold white, or blanched, the furrows should be plowed out so that the crowns of the plants can be set from 2 to 4 inches deeper, or from 7 to 10 inches deep.

Deep planting is desirable not only for blanching the shoots in the production of white asparagus but also for other reasons. The habit of growth of the asparagus plant is to form the new buds, from which the edible stalks are produced, a little higher on the crown each year. Deep planting will thus postpone the time when there will be danger of injuring the crowns of the plants during cultivation. Deep planting is also regarded as inducing the production of shoots of large size. One disadvantage of deep planting is that the first shoots in the spring do not come through as early as when the crowns are set nearer the surface.

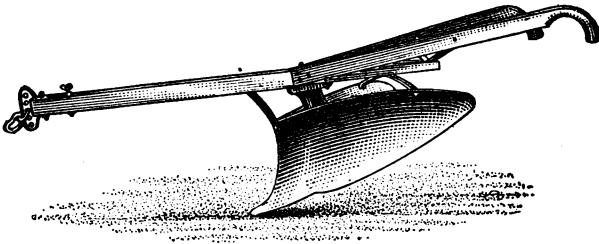
Depth of planting, however, should never be carried to an extreme. A depth of 6 to 8 inches will usually be ample, and 12 inches is the extreme limit. The depth of planting will depend to a great extent on the depth of the soil. Under no conditions should asparagus plants be set in the subsoil, because the young and tender roots could never thrive in a place where they could not secure enough plant-food or have the proper physical conditions. Much depends on setting the young plants in a congenial soil, and young plants set in a subsoil most probably would never amount to much as a commercial proposition.

57. Ordinarily the rows may be run in any direction desired, but, in order to save time in cultivation, it is customary to make them the long way of the field. The direction of the furrows is an important point to determine if the asparagus is to be planted on a hill or on a slope steep enough to wash; usually, however, asparagus is not planted in such a location. The furrows must remain at least partly unfilled during the

greater part of the first growing season, and if the soil washes, much fertility will be lost and many of the young plants may be exposed. On a field that slopes considerably, the furrows should be run at right angles to the slope; this will effectually prevent any washing and, in addition, will retain considerable water for the use of the plants.

If the land is level enough the best results will be obtained by running the furrows north and south, as this will allow all of the plants to receive the maximum sunlight.

58. The first important step in furrowing out the field is to get the first furrow straight along one edge of the field. Stakes may be used to advantage in marking out this row. A good, steady team should be selected for the work, and, if a plow is used it should cleanly turn over a wide furrow. In making the first furrow, one man should lead or drive the team, and another should guide the plow. The plow should be set to plow 8 inches deep. To complete this furrow, the plow should



F.G. 10

be brought back to the starting point in the same furrow to widen and, if necessary, deepen it and straighten out any places that are crooked. If this work is properly done, very little hand work will be required to prepare the furrow for setting the plants; the little that is necessary will consist in shoveling out the loose dirt at the ends where it may have fallen in the furrow.

The other furrows in the field are made in the same way. A good plowman may not need guides for the later rows, but others will find guide stakes a help. A plasterer's lath makes a good guide stake. It is about 4 feet in length, and this will

be a convenient length to measure the spaces between the rows. At the end of each furrow, and before the return trip in the furrow is started, if a lath is set over its length it will serve as a guide to mark the end of the next row when that row is started at the other side of the field. A lath at the side of the field on which the rows are started will likewise serve as a measuring stick to determine the spot where the next row should be started.

Instead of a plow a trencher such as shown in Fig. 10 is often used. The work can be done with greater accuracy with such an implement.

**59.** The most satisfactory plan in setting asparagus plants is to have the furrowing out and the work of setting the plants done as nearly together as possible, the setters following closely, not more than a few furrows back of the plow. In many cases, however, labor is not plentiful enough to allow of such a system, but, at all events, no more furrows should be plowed out in a day than can be set in that day, because the drying out of the soil in a furrow makes conditions that are unfavorable to the young plants.

After the furrows are made a light coat of well-rotted manure should be spread in the bottom of the furrow. This step is one of the most important that can be taken, as the manure will furnish the best kind of plant-food for the young plants and hold water for them. If manure is not available, and the land is well supplied with humus, an application of about 500 pounds to the acre of a good fertilizer will be found profitable; this, however, should not be strong enough to burn the roots. When fertilizer is put in the bottom of the furrow, it should be covered lightly with soil before the plants are set.

**60. Details of Setting.**—For the operation of setting asparagus plants, gangs of three men each work to best advantage. One distributes the plants at the proper distances along two adjacent rows and the other two, one in each row, do the setting. As in the setting of any other plants, great care should be taken to see that the roots are not exposed to the sun or wind longer than necessary; preferably the roots should

be protected by a wet piece of burlap until they are dropped in the row. For this reason also the person dropping the plants should keep just ahead of those doing the setting.

The details of setting are about as follows: The plants should be dropped about 2 feet apart along the row, slightly in advance of the two men who do the setting. The plants should be set directly in line, with the buds, or crown, a trifle elevated and with the roots spread out in all directions and not doubled under the plant, as they often are when carelessly set. To accomplish this, the setter should pick up the plant with one hand and with the other draw a handful of soil to the center of the furrow and make a little mound. Then the root

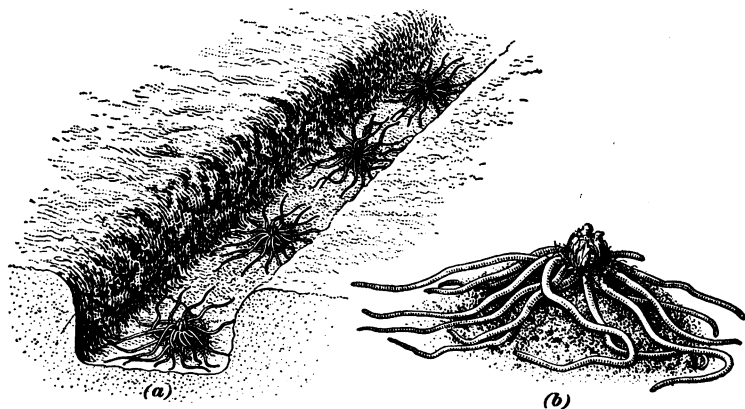


FIG. 11

should be set on this mound and the small roots spread in every direction, as shown in Fig. 11 (a). A single plant set on a mound is shown in (b). With a little practice all this can be done in one motion with one hand. Then, with one hand holding the root in place, soil should be drawn onto it with the other, first from one side and then from the other, covering it to a depth of about 2 inches. According to this method of setting four motions and no more are required. The work cannot be properly done with less, and time is wasted in using more.

Assisted by a man to drop plants along two rows, each of the two setters following him should set from 1,200 to 1,500 plants in a day of 10 hours and do the work well.

**61.** After the setting has been finished the asparagus bed will be a series of ridges and furrows. This is the proper condition for the field, because, if the furrows were completely filled up and the ground leveled off, the young plants would be covered with too much soil; this would kill many of them and weaken others. The furrows should be filled very gradually, the process taking the whole of the first growing season. At each cultivation and hoeing for the destruction of weeds and the maintenance of a dust mulch, the furrows will be filled up a little, so that by fall the field will be practically level.

**62. Rotation.**—Asparagus should not be followed too closely by asparagus on the same piece of soil. Time should be allowed for the insect pests to starve and for the spores of the fungous diseases to perish. Usually, the land should be devoted to other crops for 2 years before being replanted to asparagus.

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#### CULTIVATION AND GENERAL CARE

**63. Cultivation and Intercropping.**—Because of the need of the asparagus plant for large quantities of water, thorough cultivation is essential. Not only must the weeds be kept down but a dust mulch must be maintained all through the season. When some hoed crop is grown between the rows the first year, the cultivation is likely to be more thorough, at least during the time that the crop is being tended, than when no companion crop at all is grown; hence the oft-repeated advice to grow such a crop between the rows in an asparagus bed.

Where asparagus is planted in rows 4 feet apart, there is room to grow a companion crop between the rows without interfering with the growth of the asparagus. In some cases two rows of lettuce, spinach, radishes, or other small, short-season crop, or a row of snap beans or a similar crop are grown between the rows. Where the asparagus rows are planted 3 feet apart, not more than one row of a companion crop should be planted. A corner of an asparagus bed with young plants in it and intercropped with a row of lettuce is shown in Fig. 12. The advisability of intercropping asparagus depends to a considerable extent on the efficiency of the management.

64. Cultivation the first year should begin a few days after the plants are set. Sometimes a hand rake is used for this purpose, the ground on the edges of the furrows being raked as well as that between the rows. More often, however, a one-horse cultivator is started to work at once; a one-horse cultivator is probably the most satisfactory tillage implement to use in an asparagus plantation, though hand hoeing at times during the cutting season may be necessary. One prominent asparagus grower in New Jersey, with somewhat more than 20 acres planted in this crop, has one man and a horse whose



FIG. 12

entire work throughout the season, until the tops are spread so that it is impossible to get between the rows, is confined to the cultivation of this area. In a little less than 3 days the man can cover the entire patch and as soon as he has finished he begins over again. The soil is sandy and can thus be cultivated very shortly after a rain, so that weather conditions interfere but little with this man's work. This may seem like carrying cultivation to an extreme, but the large yields from this patch seem to justify the expense, although proper and heavy fertilization and efficiency in management also have considerable to do with the success. The soil should be gradually filled in

the furrows as the season progresses until the furrow that at first had the appearance of the one in Fig. 11 (a) looks those in Fig. 13.

65. At the beginning of the second year, the ground should be broken up, preferably with a disk or a cutaway harrow; such harrows will work all of the ground, both between and over the rows. The manure should be well mixed with the soil by this harrowing. Great care should be taken at this harrowing not to injure the roots by running the disks too deep, because such injuries mean a proportionately diminished yield. The plan of plowing shallow furrows with a small plow between the rows that is advised by some growers often does serious injury to the roots. The later cultivation during the second and subsequent seasons is the same as that previously described.

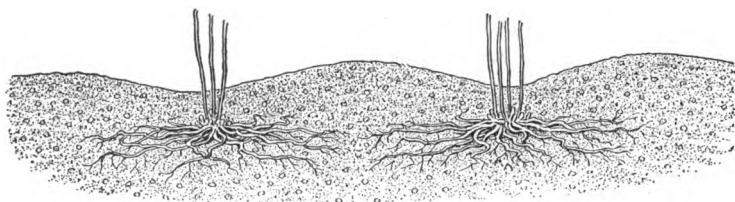


FIG. 13

In an old asparagus patch, cultivation will always do some damage to the roots and also possibly to the buds, but as the cultivation is too important to omit, injury at this stage of the plantation cannot be avoided. Injury of this kind to an old plant is not, however, as serious as it is to a young one. This is due to the fact that an old plant will have a much larger root system than a young one. A few dozen roots broken near the surface might represent an injury to less than 1 per cent. of the root system of an old plant; a few dozen roots destroyed on a young plant might mean the loss of 10 to 20 per cent., or more, of its total root system, and hence the loss to the food-getting and food-storing apparatus of the plant would be much more of a calamity.

66. **Ridging.**—To provide a good depth of soil over the crowns, ridging to some extent is commonly practiced in nearly

all asparagus beds. This, of course, is practically essential when white asparagus is grown for market and is also largely done to a less height when green asparagus is grown. Special implements known as *ridgers* are used for this purpose. Fig. 14 shows a common five-tooth one-horse cultivator with what are known as *ridgers*, *hillers*, or *shovels*, attached in place of the two outside teeth, this implement somewhat resembles a plow in its action. A type of disk ridger is shown in Fig. 15. Both kinds of ridgers are used extensively. A home-made ridger can be constructed by fastening boards on a cultivator frame and using the small cultivator plows. The disk ridger is

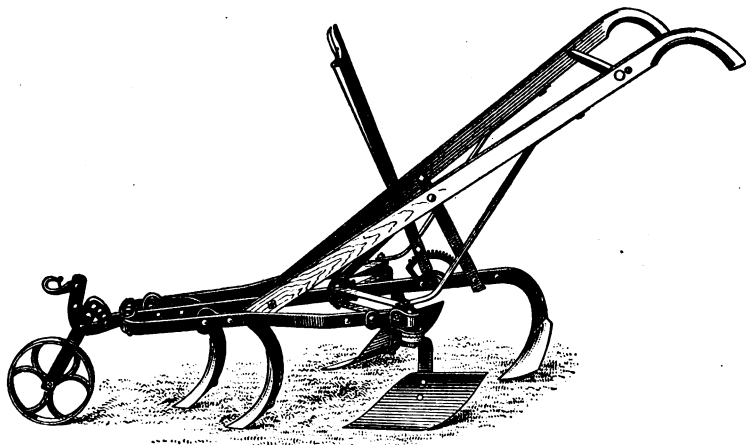


FIG. 14

probably the best implement to use, but it is not necessary for a small area unless it can be used to advantage on other crops.

Ridging is usually started about the beginning of the third season of growth and so much soil should not be thrown on top of the rows that the young shoots will have difficulty in forcing their way through. The ridges will vary from 3 inches to 8 inches in height, but judgment must be used in this matter.

As soon as the cutting season is over, the ridges are leveled off. This may be done by running a disk harrow directly over the center of the ridge, or may be done by means of a special leveling device shown in Fig. 16; such a device may also be

attached to the disk ridger shown in Fig. 15. The levelers are the straight metal parts below the disks. Breaking down the ridges in this way will effectually destroy any weeds in the rows, and before a new crop of weeds will have the opportunity to spring up, the asparagus tops should have the ground well shaded. Each subsequent year the rows should thus be ridged up early in the spring, and then leveled off again as soon as the cutting season is over.



FIG. 15

**67. Management After Cutting Season.**—After the cutting season is over a vigorous and properly fertilized asparagus plant will grow from four to ten stalks that will average in height from 4 to 6 feet and sometimes even higher. These stalks should be allowed to grow undisturbed until their growth is matured in the fall. Some growers recommend that they should then be cut down, taken off the field, and burned, especially if asparagus rust is prevalent, and the ashes returned to the field as fertilizer. Others prefer to cut the stalks, leave them on the field during the winter, and disk them under in the spring

when they have become broken down and softened by weathering; by this practice they supply the soil with considerable humus as well as fertilizer.

Just what to do in any particular case is a problem sometimes difficult to solve. At first thought, the removing and burning of the stalks would seem to be one of the surest ways of eliminating the rust, but unfortunately the rust fungus fruits in the fall and the spores are scattered by the millions on the soil of the field and adjoining territory, and it is hardly possible that

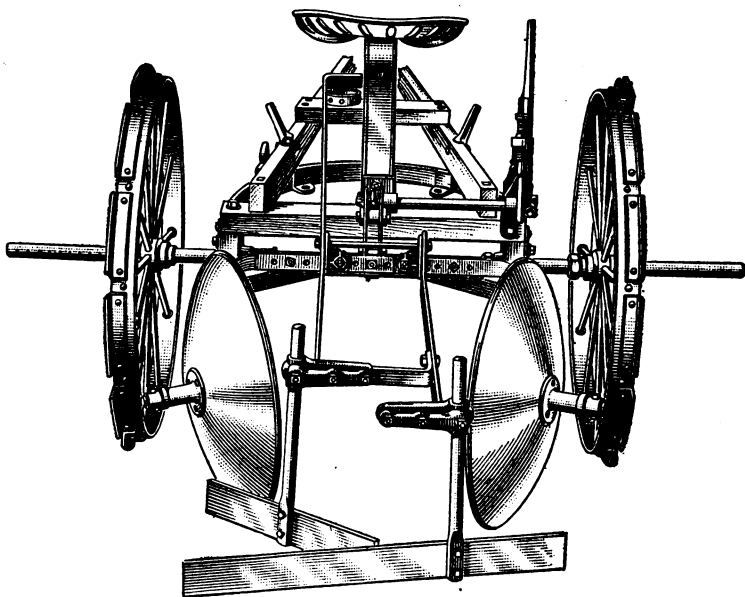


FIG. 16

the rust still on the stalks when time for cutting comes would make matters much worse. To cut down the asparagus stalks when the rust first appears is also impracticable, for the loss of the leaf surface would greatly weaken the plants, and, if persisted in, would kill them. Hence, such a remedy would be much worse than the injury caused by the disease. As the rust makes little headway on the very vigorous plants of certain varieties, the safest plan is to work the plantation so that the plants will be vigorous and to plant only rust-resistant varieties.

# ASPARAGUS

(PART 2)

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## FORCING AND FERTILIZATION

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### FORCING

1. Asparagus is one of the few vegetables that can be forced for market out of season without special or expensive equipment beyond that commonly possessed by the average vegetable grower. Forcing of asparagus is possible because of its habit of storing up food in its fleshy root system. Normally, this stored up food is used for the production of shoots and tops the following spring and summer, but, if conditions suitable to the growth of the plant are provided, the roots may be made to liberate their stored food and send up shoots prematurely. Hence, when favorable conditions are provided during the winter, or several weeks earlier in the spring than the crop will develop outdoors, the buds in the crown may be made to develop and produce shoots that will be fit for market. Such a growth can be made to occur anywhere that the proper moisture and temperature conditions can be provided. Light is not necessary.

Until within very recent years fresh asparagus has never been seen in the markets, even of the large cities, except from April to August, and the largest part of the crop has been, and still is, sent to market during the latter part of April, May, June, and July. Now, however, it appears in the market also in February, March, August, November, and December, because asparagus is grown in Southern localities and shipped North,

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and because it is forced and sold locally. Most of the forced asparagus is grown to precede the field-grown crop in the market by several weeks. The bulk of the forced crop comes into the market during February and March, although it is also sent to market from November on. In all probability, asparagus may soon be produced for market at all seasons of the year and meet a limited but constant demand.

2. Strong, mature roots are essential to success in forcing asparagus. Only roots 3 years old or older are suitable for forcing, and roots up to 10 and 15 years old and older may be used. To make a business of asparagus forcing, an annual supply of strong, mature roots is necessary. The quality of the forced asparagus depends very largely on the nature, or inherent character, of the root. A root that will produce small, inferior shoots in the field will produce small, inferior shoots in the forcing bed. The reverse is also true. The yield of shoots per root will depend entirely on the strength of the root. A 3-year-old root might produce from  $\frac{1}{4}$  to  $\frac{1}{2}$  pound of shoots, while a 4-year-old root might produce from 1 to 2 pounds of shoots. No authentic records have been kept of yields from forced asparagus roots, and hence a probable average yield can be given only in general terms.

The forcing of asparagus may be done in any place where the asparagus roots when set may be covered with 2 to 8 inches of soil, provided an ample supply of water can be supplied and the proper temperature maintained. As previously mentioned, light is not necessary. Such conditions may be secured in a hotbed, in a house cellar, in the space beneath a greenhouse bench, and may even be secured in part of an asparagus field where heat may be supplied out of season.

3. To make a business of asparagus forcing, a sufficient, annual supply of new, strong, mature roots is necessary, because the roots are useless after they have been forced and must be discarded; such a practice is cheaper and generally more satisfactory than to attempt to resuscitate the forced roots. The annual production of such a supply of roots will necessitate an annual planting of seeds and an annual production of plants

of the proper age. The ground used for producing such roots will have to be devoted to the crop for at least 3 years, and maybe for 4 years, if experiment shows that the 4-year-old roots will bring a sufficiently large net return to warrant the extra cost. In some cases, a grower may wish to secure a little extra profit out of the roots of an asparagus bed that he is intending to abandon. In such a case, the business is only incidental to the regular work on the farm and the roots are merely forced for 1 year and the product sold locally for whatever it will bring. A good profit may often be made in this way, but such forcing does not require the planning that a continuous annual forcing will require, and the profits often appear to be exceptional, because the roots are not figured as costing anything.

4. The production of asparagus roots for forcing is done in much the same way that roots are grown for field planting. The chief difference may be in the length of time the roots occupy the ground before being moved. As 1-year-old roots are preferred for field setting, the plants are usually transplanted at that age, but as roots at least 3 years old are required for forcing, the asparagus plants must either be transplanted to the required distances in a separate field when they are 1-year-old, or the seed must be so planted that the plants may be easily thinned to the required distances and allowed to stay for 3 years or more in the same soil. The question of expense should decide which method should be followed

When hand cultivation is practicable, asparagus roots for forcing should be grown in rows 18 to 20 inches apart, and the plants spaced from 12 to 15 inches apart in the row. These distances will provide sufficient room for the development of strong 3-year-old roots if the ground is kept well supplied with moisture and plant-food. At these distances from 20,000 to nearly 30,000 plants may be produced on 1 acre. If horse cultivation is to be practiced the asparagus plants should be grown in rows from 24 to 30 inches apart and be spaced from 15 to 18 inches apart in the row. At these distances from a little more than 11,000 to more than 17,000 plants may be produced on 1 acre.

5. As previously mentioned, an increase in the size and vigor of asparagus roots may be obtained by starting the seed in flats in a hotbed or greenhouse early in February, or several weeks before planting time, and then transplanting the seedlings in the field. When producing plants for forcing, this practice could be carried out to advantage, because the seedlings could then be set at the distances they would grow in for at least 3 years.

A 3-year-old root, suitable for forcing should have a spread of 24 to 30 inches or more, and the crown should consist of a cluster of ten buds or more. Older roots should be larger and should have more buds in proportion.

Roots intended for forcing should be dug before the ground freezes in the fall and be stored in a cellar or shed where they can be covered with sand to prevent them from drying out. Freezing does not injure the roots stored in this way, provided they are not alternately frozen and thawed. They must be kept in a temperature below 40° F. to prevent the premature starting of the buds.

6. Asparagus roots intended for forcing should be set about 10 days to 2 weeks before the first cutting is desired. The method of setting the roots will be practically the same no matter where they may be set. They should be set on top of 3 or 4 inches of soil. The roots should be so spread out that all will come in contact with the soil. The plants should be set close together, in order to economize space, and it makes little difference if some of the roots of one plant overlap those of another. An abundant supply of moisture is the most necessary requisite in a soil in forcing asparagus, as the plants derive practically no plant-food from the soil. After the plants are properly arranged on the ground, from 2 to 8 inches of soil is placed over the crowns, according to whether green or white shoots are desired; if the forcing is done in the dark, white shoots will be obtained with a 2-inch covering of soil. The soil above the crowns should then be thoroughly watered and the ground packed closely about the roots to close up any air spaces. The soil should be kept continually moist.

7. To induce on the old roots the development of new roots that will take up water rapidly as required by the growth of the shoots, the temperature of the forcing place for the first few days should be kept between 45° and 50° F.; the temperature may then be raised to 65° or 75° F., according to the rate of growth desired. Too high a temperature should not be main-

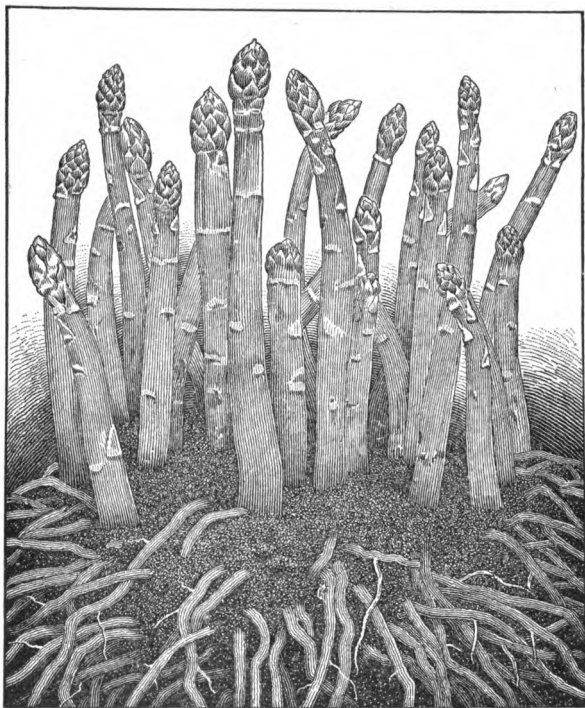


FIG. 1

tained, however, as this will tend to induce a soft, spindling growth. Too low a temperature may, on the other hand, produce too slow a growth. The exercise of a little judgment is necessary in the regulation of the temperature.

Asparagus roots should show growth in 1 week or 10 days after they are placed in the soil provided proper temperature and moisture conditions have been maintained. Cutting may

begin in 10 days to 2 weeks from the time of setting, and may be kept up for 3 or 4 weeks, or until the roots are no longer capable of producing marketable shoots. In some instances, eight cuttings at intervals of 3 or 4 days apart have been obtained. A forced asparagus plant that has been lifted from the bed in which it was growing is shown in Fig. 1.

Asparagus may be forced in the field by surrounding the plants with cold frames and supplying heat. The roots may be closely planted for this particular purpose and cold frames built in the field over them covered with sash and surrounded with heating manure. By this method of applying heat an early crop can be very satisfactorily obtained. Steam has also been used in heating sections of a field over which a frame has been constructed, but this method of applying heat is rather expensive for this purpose.

Forced asparagus should be handled more carefully than field-grown asparagus, as it is more susceptible to injury, and is a higher-priced product. The bunches should be wrapped in oiled paper, labeled with attractive labels, and marketed in special, attractive packages.

8. Whether or not the forcing of asparagus will prove profitable is a matter that must be determined by each individual for himself. The cost of production is much higher than for the field-grown crop, and not only must fancy prices be secured for a small quantity, as may be the case in a large number of places, but, if much profit is to be secured, the market must be large enough to take considerable quantities at a fancy price. The cost of labor and the other expenses connected with the forcing of asparagus makes its sale at ordinary prices unprofitable.

A price of 75 cents a pound is sometimes paid for forced asparagus in the winter, and a price of \$10 per dozen 2-pound bunches is not uncommon. The demand for this kind of asparagus is most active in the larger cities, though it is probable that some forced asparagus would find a sale in many of the smaller markets that have not yet been tried to any extent on this product.

### FERTILIZATION

9. To mature each crop and to maintain its productiveness over a series of years, asparagus requires abundant feeding. The drain on the vitality of the plant caused by the cutting for 2 months or more of all the shoots that are normally intended for stalks is very great. Then, in addition, the plant must send up other shoots that will be sufficiently vigorous to elaborate enough plant-food in the leaves for the storage in the roots of the energy that is to produce the crop of the following spring. The process is not a natural one and hence the method of treatment must also be exceptional.

Asparagus responds very readily to fertilization, and practically never is this part of the work overdone. Very few vegetable crops will show as great a profit from fertilization as asparagus, and many growers spend \$80, or more, per acre per year on their beds in commercial fertilizers alone. Other conditions being favorable, even such an expenditure will show a handsome return in an increased yield.

On almost all asparagus plantations the use of both stable manure and commercial fertilizer will be found profitable. Some growers claim that they can get along without stable manure by using large quantities of commercial fertilizer. Such a practice, however, would not be considered safe until after extensive experiments had been conducted. Asparagus requires large quantities of water and, normally, only a soil containing large quantities of humus will hold enough water to induce an early and continuous yield of stalks. Few soils, except some virgin soils, have enough humus to prove satisfactory. Under irrigation, the quantity of humus in a soil may not be so important as where no artificial supply of water is available.

10. On an average, an asparagus bed in full bearing requires the application of 10 to 15 tons of stable manure to the acre annually, and the application of 1 to 3 tons of commercial fertilizer. A greater quantity of stable manure can also usually be applied to advantage. As asparagus, like all other vegetable

crops, requires a soil free from acid to give the best results, an application of lime is often necessary. Unless the land has long been neglected, about 1 ton of air-slaked lime to the acre should be enough to remedy acid conditions. If ground limestone is used, 2 tons to the acre would not be too much to use.

The quantity of stable manure and commercial fertilizer that can be profitably applied to asparagus annually bears no relation to the quantity of plant-food that is removed from a field when the shoots are harvested. According to Wolff's analyses, 1 ton of fresh asparagus sprouts contains 6.4 pounds of nitrogen, 1.8 pounds of phosphoric acid, and 2.4 pounds of potash. A crop of 2 tons of asparagus would thus remove from the soil only 12.8 pounds of nitrogen, 3.6 pounds of phosphoric acid, and 4.8 pounds of potash; such quantities of plant-food are found in about 85 pounds of 15-per-cent. nitrate of soda, about 28 pounds of 13-per-cent. phosphate rock, and about 9.6 pounds of 50-per-cent. muriate of potash; these materials would cost about \$2.50 if bought in large quantities. In addition to the shoots that are harvested, several tons of roots and tops are also produced each year per acre, and sufficient plant-food must be supplied for these. The total weight of all the vegetable growth on an acre of asparagus bed would not, however, account for all of the plant-food applied in fertilization. Many theories have been advanced for the necessity of applying such apparently excessive quantities, but no doubt the fact that the growth must not only be abundant but also quick has a great deal to do with it; any shortage of plant-food would necessarily greatly retard the rapidity of growth. Of the three plant-foods previously mentioned, nitrogen is the most important to asparagus, and, unfortunately, also the most expensive. This should be applied both in the form of nitrate of soda and in organic fertilizers, such as stable manure, tankage, dried blood, etc.

11. The proper time for the application of fertilizers to asparagus is important, but all authorities do not agree on the same system. These differences of opinion are due, no doubt, to some extent to the differences in soils on which widely

separated asparagus beds have been planted. On soils that will hold fertilizers well, the time of application of every fertilizer, except perhaps nitrate of soda, would not be so important as on soils that leach readily; great wastes occur on leachy soils by an unsystematic application of fertilizers.

The peculiarity of growth and harvesting is responsible for the importance of the time element in applying fertilizers to asparagus. Most commercial plants produce blossoms, leaves, and stems first, and their marketable product afterward in the same season. With asparagus this scheme of growth is reversed. The marketable product is produced early in the spring from the elaborated food produced in the leaves and stored in the roots late the previous summer. Hence, fertilizers must be applied to asparagus with two purposes in view: (1) Food must be supplied to assist the roots to produce a large quantity of shoots early in the spring, emphasis being laid on the earliness of the crop as well as on the quantity, and (2) food must be supplied to assist the roots to develop the shoots sent up during the latter part of June into sturdy stalks that will bear an abundant crop of leaves, and thus put the roots themselves in a condition to stand the necessarily heavy production of shoots the following spring.

12. Because of the great variations in soils, no definite method of application of fertilizers that would be infallible under all conditions can be given. To produce the best results, experiments are necessary on every bed, and any who do not experiment carefully will not apply their fertilizers most economically. Some authorities claim that the most effective time to apply nearly all the fertilizer to asparagus is after the cutting season is over; others, among whom is Voorhees, claim that the best results are obtained by applying fertilizers early in the spring, especially in the case of the production of green asparagus. As a compromise between these two methods, and in the belief that the requirements of the two stages of growth of the asparagus plant are better met by it, the following method of fertilization is suggested for those new at asparagus culture, and for use until experiments can be made to

determine a method of application better suited to any particular set of conditions:

1. As previously mentioned, a heavy dressing of well-rotted manure should be applied in the furrows before the young asparagus plants are set. If enough manure is not available about 500 pounds of a fertilizer analyzing 5 per cent. of nitrogen, 8 per cent. of phosphoric acid, and 10 per cent. of potash, may be applied in the rows. To prevent burning, however, this should be covered with soil before the roots are set.

2. A few days after the young plants have been set about 1,000 pounds of a 6-8-10 fertilizer to the acre should be applied between the rows, and as close to the young plants as possible without running any danger of burning them. About 3 weeks later an application of 150 to 200 pounds of nitrate of soda to the acre should be made along the rows. This should be repeated at intervals of 3 or 4 weeks until three or four applications have been made. This may seem like a large expense for the first year, but the effect of giving the young plants plenty of food at the start will be marked in later years. A good start is half the battle.

3. Before growth starts the second spring a liberal top dressing of fine stable manure should be made. On an average, about 10 to 15 tons should be applied; some growers apply twice that quantity with beneficial results. Of late years the tendency has been to apply 10 to 15 tons of good stable manure annually, and to supplement it with large quantities of commercial fertilizers; formerly many growers advised applying 30 tons of stable manure and no commercial fertilizer. Some prefer to apply the stable manure the first fall rather than the second spring, but more benefit will probably be secured from the spring application. If the manure is coarse and strawy it should be applied in midwinter. The manure should be broadcasted between the rows and harrowed in and preferably should not be applied over them; on many farms, however, the manure is broadcasted over the field without regard for the location of the rows. Mulching the plants with manure is considered to have a tendency to cause the crowns of the plants to grow rapidly up toward the surface where they may be damaged by

cultivation. About the same quantities of fertilizers as recommended in paragraph 2 should also be applied the second year and in the same way.

4. If no crop is to be cut the third spring, the fertilization of the asparagus bed is the same as that recommended in paragraph 3. If a crop, or rather a half crop, is to be harvested the third spring, the following is recommended: About 15 tons of fine stable manure should be applied either early in the spring or just after the cutting season is over. On many beds the benefit will be the same in either case; on others it may not; usually the time of this application is largely a matter of economy of labor. About 1,500 pounds of a commercial fertilizer, analyzing from 4-8-10 to 6-8-10, or possibly one containing less phosphoric acid and potash, should be applied as early in the spring as the ground will permit. As soon as growth begins, about 150 to 200 pounds of nitrate of soda should be applied along the rows, care being taken not to get it too close to the plants to burn them nor so far away from them as to be ineffective. A second application of 150 to 200 pounds of nitrate of soda should be made about a month after cutting starts, and a third application at the close of the cutting season. Following the third application of nitrate of soda another application of about 1,500 pounds of the same fertilizer used at the beginning of spring should be made. If the manure is to be applied after the cutting season is over, it should be put on a few days after the fertilizer has been applied. About 1 month later, another application of 150 to 200 pounds of nitrate of soda can often profitably be made.

5. The fertilization in subsequent years will be the same as that suggested in paragraph 4, with such modifications as experience may seem to justify.

13. Formerly, large quantities of common rock salt and granulated salt were used on asparagus beds on the supposition that it was in some way very beneficial to the growth of asparagus. Salt, of course, will stunt the growth of weeds and probably takes up some moisture from the air, but it has no plant-food value and its use is no longer considered economical.

## INSECT PESTS AND INJURIES

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### INSECT PESTS

14. Asparagus is attacked by three important insect pests, all of which are found principally in the states along the Atlantic coast. Given in the order of their importance, these insects are the *common asparagus beetle*, the *twelve-spotted asparagus beetle*, and the *asparagus miner*.

15. The *common asparagus beetle* has been known in this country since 1860. It is a slender beetle about  $\frac{1}{4}$  inch long, and yellow and black in color; its markings are well shown in Fig. 2 (a); the larva is shown enlarged in (b).

Two and often three broods of beetles are produced in a season. The life history of the insect is about as follows: The adult beetle emerges from its winter quarters under some rubbish about the last of April or the first part of May, or at about the same time the first asparagus shoots push their heads above ground. The beetle immediately scurries to the asparagus bed and begins to devour the tops of any available shoots. Almost simultaneously it also begins to lay eggs. These are set on the shoots in rows of three to six; later in the season the eggs will also be laid on the full-grown stalks and on the leaves; egg laying is continuous throughout the season. Depending on weather conditions, these eggs will hatch in from 3 to 8 days. A very small slate-colored larva emerges from the egg, and immediately goes to eating, which process is continued until the larva is full grown, a matter of from 10 to 15 days. When it has completed its growth, the larva drops from the plant, crawls into the soil and makes a soil cocoon similar to that of the cutworm. After 5 to 10 days in this cocoon the insect emerges as an adult beetle, and goes through the same life history just described. The adult beetle from the

last brood of the season crawls under some rubbish or similar material and there spends the winter.

The principal damage done by the common asparagus beetle during the cutting season is the chewing of the heads of the young shoots, which by disfiguring them reduces their market value and even sometimes renders them unmarketable. On a commercial plantation of cutting age and during the cutting season, the adult beetles are destructive but the larvas get little opportunity to do damage, for the rows are so frequently cut clean of stalks that no opportunity is given for the eggs to hatch. On a new plantation and on seedling plants in a nursery row, both the beetles and the larvas do serious damage by destroying foliage and checking growth at a time when abundant foliage and vigorous growth are of prime importance.

16. The control of the asparagus beetle, especially when numerous, is a serious problem. On a cutting bed, the first brood is largely kept down by frequent harvesting, which results in the removal and destruction of the eggs.

Poisons should not be applied at this time on account of the injurious effects that might result to consumers who eat the vegetable in large quantities. On a bearing bed, poisons should be resorted to after July 1, or after the cutting season is over. On a young plantation, that is, before the cutting age is reached, and on seedling plants in a nursery row, poisons should be applied early in the spring and should be used systematically

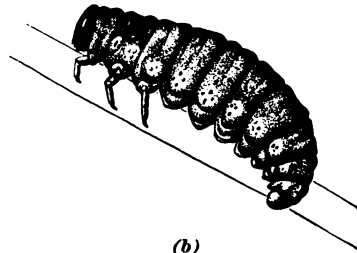


FIG. 2

as long as any beetles or larvas are present. The character of the asparagus plant is such that liquids do not adhere well to it and dusting the plants with a powder poison when the dew is on the plant is as effective a method as any, though, of course, this must be done early in the morning and, as the dew does not stay for any length of time, the work must be done rapidly to cover much of an area. A small hand bellows is suitable for rapidly dusting a small acreage of asparagus. Paris green mixed with plaster, or gypsum, in the proportion of 1 pound of Paris green for every 50 pounds of plaster, makes an effective insecticide. Arsenate of lead, 2 pounds, and plaster 50 pounds, also makes a good insecticide. Finely powdered freshly air-slaked lime is effective against the larvas, as it acts as a caustic-contact insecticide.

One fortunate circumstance for the asparagus grower is the fact that the asparagus beetle itself has a number of insect enemies, chief among which is a spotted lady bug, one of that family of most helpful insects. At least, three or four other insects also feed on the asparagus beetle larvas, thus preventing this pest becoming as serious as it otherwise might with its three broods a year.

As the asparagus beetle winters over in rubbish, grassy borders, cracks in stone walls, and in similar places adjacent to the asparagus bed, clean cultivation, frequent cleaning out of fence rows, etc. will help to rid a bed of this pest.

In some instances, growers keep chickens in their asparagus beds, the coops being placed at one side of the field and the fowls allowed to run at will during certain times of the day. Fowls are very active feeders, especially where they can find an abundance of insects, and when properly managed they will very effectively keep down the number of beetles, larvas, and other insects. Ordinarily, fowls will do little or no damage to the young shoots; but if they do form the bad habit of picking at the shoots, they should be driven off at night and not allowed on the bed again until after the shoots are cut in the morning.

**17.** The **twelve-spotted asparagus beetle** is second in importance of the insect pests attacking asparagus. It is

very similar in shape and size to the common asparagus beetle, but it is so differently marked as to be easily recognized. The back is orange red in color, and each wing is marked with six black spots—hence, the name. This beetle is a native of Europe, and usually is not a serious pest, though at times it becomes troublesome. In this country it has been known since 1881; it is fairly well distributed over the Central Atlantic states.

The adult beetle does the principal damage by eating the marketable stalks in the spring. Later in the season the adult beetle and its larvas feed principally on the asparagus berries, and hence, except where seed is to be saved, they are of little importance at this stage. The adult beetle is shown enlarged in Fig. 3 (a), and the larva in (b).

The twelve-spotted asparagus beetle lays its eggs in a horizontal position on the asparagus stalk, a few in a place. The eggs take about the same time to hatch as do those of the common asparagus beetle, and their subsequent development proceeds at about the same rate.

The twelve-spotted asparagus beetle is more difficult to combat than the common asparagus beetle, but as they are less abundant and do less damage, not much attention has been directed toward their control. Apparently, predacious insects are responsible for the scarcity of the twelve-spotted asparagus beetle.

18. The **asparagus miner** deserves mention as an asparagus enemy as it sometimes does damage. The adult insect, shown enlarged in Fig. 4 (a), is a small black fly that lays its eggs on the stalks early in June. The eggs hatch in a few days and small larvas, or maggots, one of which is shown in (b), emerge and work their way into the stalks below the

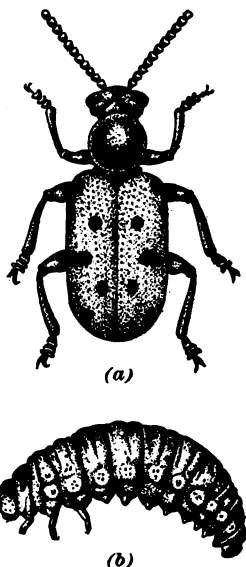
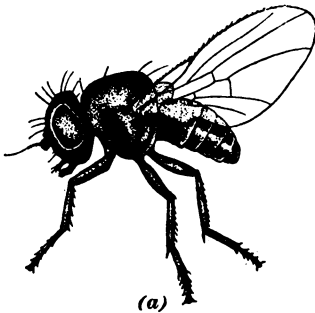


FIG. 3

ground surface. The maggots then feed on the juice within the stalk, greatly weakening it.

No practical method of preventing injury by the asparagus miner has been developed, although some advise the use of



(a)



(b)

FIG. 4

lure plants and then burning these about the middle or latter part of June. A lure plant is one that is allowed to develop on the theory that the asparagus miner will be attracted to it to lay its eggs. After the eggs are laid and the maggot has entered the stalk, burning the stalk will naturally destroy the insect. Whether the expense of this method justifies its use is a matter of individual judgment. The method of preventing the asparagus miner from seriously damaging any asparagus bed corresponds very closely with the best method of cutting the bed. That is, cutting the bed clean during the entire market season,

or allowing no shoots to develop beyond the edible stage until the latter part of June, will remove the material on which the asparagus miner can work and thus will result in starving it out.

### DISEASES OF ASPARAGUS

19. Asparagus is subject to attack by at least three fungous diseases, but of these only the **asparagus rust** is of sufficient importance to require attention. The presence of asparagus rust in a field can almost surely be recognized, even at a distance, by the early maturing of the tops during the middle or the late part of the summer; they turn yellow and look ripe. Close examination of such plants will reveal the presence of spots on the stems, as shown in Fig. 5, and these will be most

abundant near the ground. These spots are caused by the splitting, because of fungous growth, of the outside covering of the stalk; they vary from  $\frac{1}{8}$  to  $\frac{1}{2}$  inch in length and are about  $\frac{1}{8}$  inch wide at the middle. The middle of the opening appears to be covered with a brown or black powder, which is a mass of the rust spores. These spores are carried by the wind to other plants and thus spread the disease.

Much experimenting has been done to discover a method of controlling asparagus rust. Spraying has not proved effective.

The most satisfactory practice is to avoid the ravages of the disease as much as possible by setting only plants of those varieties that are known to be at least partly immune to the disease. Proper attention to cultural methods is also an important factor. As a rule, vigorous, strong-growing plants, such as are produced under good management, suffer less from rust than plants of indifferent vigor or those that have been weakened by other causes. For instance, in dry seasons when the plants are greatly weakened by a lack of water, the rust is particularly destructive. Whenever an asparagus plantation becomes infested with the rust vigorous measures may with advantage be applied to eradicate it.

The most effective of these will be cutting down and burning the tops in the fall after they have matured but before they become brittle; some growers make this a regular part of their work. If, however, the tops are cut too soon the roots will be weakened and if the tops are cut late great quantities of spores will have already been distributed over the soil. Then, too, an entire plantation is weakened by a single attack of the disease, and its productiveness impaired. Prevention by the selection of rust resistant varieties is, after all, the best proposition for the commercial grower.

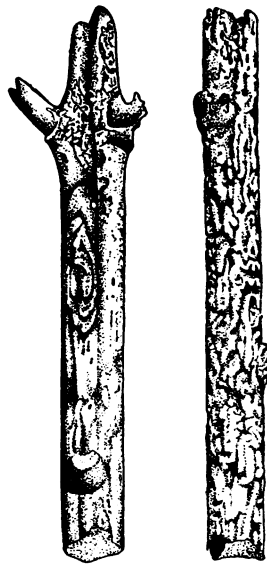


FIG. 5

## HARVESTING AND MARKETING

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### HARVESTING

**20. Cutting and Picking.**—As a general thing, most experienced growers advise against harvesting any of the shoots from an asparagus bed until its third season of growth. The first season of growth after transplanting, an asparagus plant will normally send up three or four good-sized stalks, which will grow from 30 to 40 inches high. The second season of growth the number of stalks on a vigorous plant should be increased by two or three, be proportionately larger, and grow from 4 to 6 feet high.

In the case of a very vigorous plantation, the cutting of a small crop the second season of growth may not be harmful, and cases have been known where, at this age, 200 or more bunches have been cut to the acre. Any considerable cutting for market, however, should be deferred until the third season of growth, and then the cutting should last only from 4 to 6 weeks, the length of time the cutting should be continued varying somewhat with the vigor of the plants. A full crop should not be cut until the fourth year, the season commencing the latter part of April and lasting until the latter part of June. During such a full season of cutting, and when the plants have been properly cared for, between 2 and 3 tons of marketable stalks can be cut from an acre. During the last season of an asparagus bed—that is, just before it is to be plowed out—the cutting may be continued after June and as far into the summer as sufficient shoots can be obtained. Cutting after June for plants that are expected to bear a crop the following season is a great mistake, as such a practice greatly weakens the vitality of the plants, since the tops must have a certain period of growth in order to store up enough food in the roots for the production of a crop and tops the following year.

21. The details of harvesting vary in different countries and in different localities, but in all places the work must be done by hand. To facilitate the hand work, specially constructed knives are used, such as those shown in Fig. 6. These knives have blades about 10 inches long, the one in (a) has a concave blade, the one in (b) a flat blade, and the one in (c) a fish-tail blade; the lower edge is the cutting edge. Older types of asparagus cutting knives are shown in (d), (e), (f), and (g);

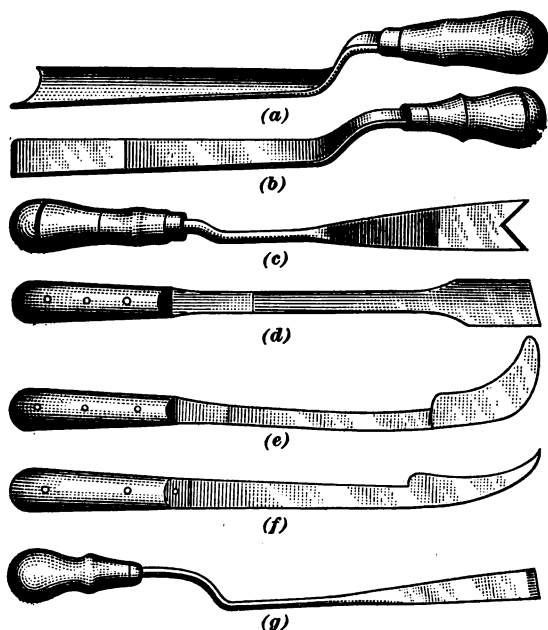


FIG. 6

some of these are still used but not as extensively as those shown in (a), (b), and (c). The knife shown in (a) is now probably most extensively used by large growers. Asparagus knives can often be improvised from knives and tools in the house. An ordinary butcher knife, with the blade broken off squarely to a 10-inch length and the end sharpened like a chisel, makes a very satisfactory cutting knife. Thin carpenter's chisels, both flat and concave, may also be used for the purpose.

In cutting green asparagus, the shoots are cut either at the surface of the ground or from 2 to 3 inches underground. As the average length required in the market is about 9 inches, the shoots are usually cut when they are 6 to 7 inches above ground. White asparagus, which is ridged several inches high, is cut as soon as the shoots poke their tips through the ground or at least as soon as they are 2 to 3 inches high. The shoots do not have to be as long as for green asparagus, averaging only from 7 to 8 inches, and hence the shoots must be cut from 5 to 6 inches underground.

Particular care should be taken in cutting not to injure any of the young stalks that are just coming up or to thrust the

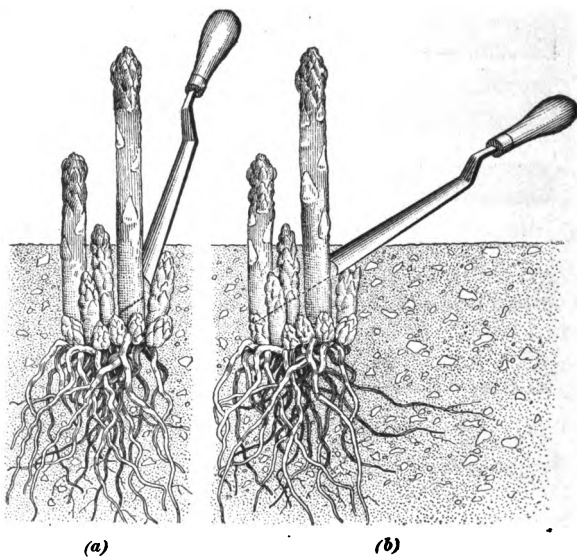


FIG. 7

knife into the crown where a number of buds may be injured. A good method of cutting is to take the tip of the stalk in the left hand and holding the knife in the right hand, thrust it slowly through the soil close to the shoot to the required depth. Then the handle should be pushed away from the stalk until the cutting edge is at a fair angle with the stalk, the knife should be pushed down, severing the stalk, and the stalk should

be pulled out of the ground. The proper method of thrusting a knife in the ground to cut an asparagus stalk is shown in Fig. 7 (a); this shows the knife pushed down close to the stalk so that no other spears are injured. In (b) is shown the improper method of thrusting an asparagus knife in the ground, and illustrates how a number of smaller shoots may be destroyed by a careless cutter, and the future crop greatly lessened. An asparagus cutter at work on green asparagus is shown in



FIG. 8

Fig. 8, and another cutter at work on white asparagus, and being followed by a picker, is shown in Fig. 9; in Fig. 9 the knife has been run down close to the stem, and then pushed down to facilitate cutting. With a little practice the operation of cutting may be performed very rapidly, in fact in much less time than it requires to tell about it.

**22.** In European countries and in some parts of the United States, asparagus shoots are broken off or pulled off by hand instead of being cut. This is the old method of harvesting,

and is usually considered much slower than cutting, but many growers prefer it because there is little or no danger of injuring the crown or immature shoots. In this method of harvesting care should be taken to see that the shoots are broken off carefully so that the crown will not be ripped or misplaced. The

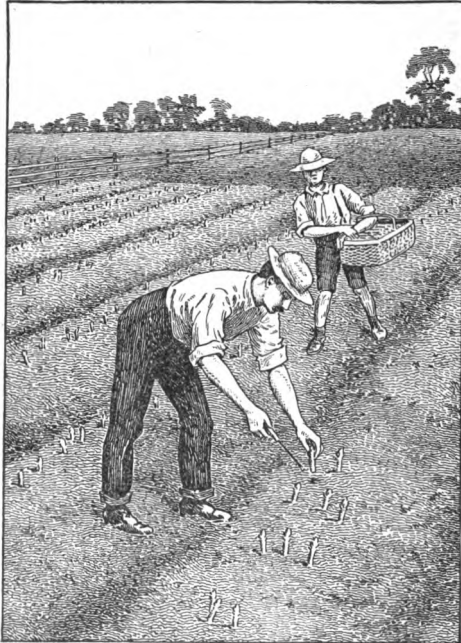


FIG. 9

common method of breaking off shoots is to thrust the fore and middle fingers of one hand down close to a stalk, avoiding as much as possible any small shoots that are still underground, and pushing the soil outward with the fingers, until the base of the shoot is reached. The forefinger is then hooked about the shoot and pressure applied gently to the shoot forwards—normally a tender, brittle shoot will snap off clean with the top of the crown at once.

The fingers being forced through the soil beside a stalk are shown in Fig. 10 (a), and the method of hooking the forefinger around base of the stalk is shown in (b).

**23.** The frequency of cutting varies with the weather and the vigor of the plants. In the cool weather of the early spring, two cuttings a week may suffice, but in warm weather the shoots should be cut daily, and sometimes two daily cuttings may be necessary to avoid loss. On Saturdays, for instance, it may be necessary to cut twice, the first cutting being made early in the morning and the second cutting late in the

afternoon in order to avoid cutting on Sunday. The shoots cut late Saturday afternoon may be kept in satisfactory condition until Monday by setting the bunches butts down in about  $\frac{1}{2}$  inch of water in shallow pans or tubs.

The work of cutting may be conducted in a number of different ways. The following method has proved satisfactory: The cutters each cut the stalks from two rows, working across the field. One man, as soon as he has cut a handful of shoots, lays it in the row at his right. The man cutting the next two rows lays his handfuls of shoots in the row at his left, putting them in line, or nearly so, with those deposited by the first man. A third person, a boy can do this work, walks along

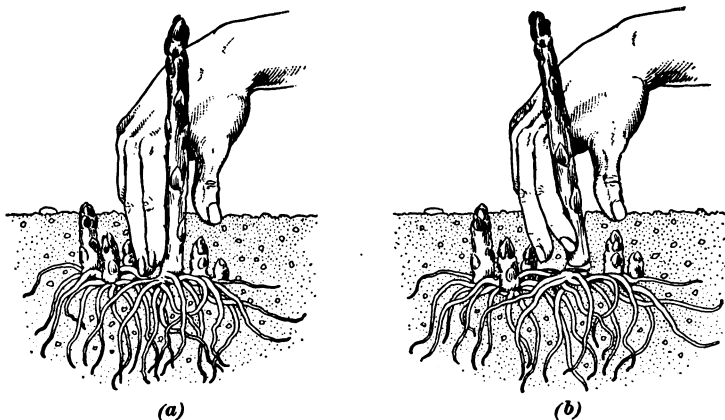


FIG. 10

between the rows where the handfuls have been laid, and picks up the cut shoots, placing them in baskets taking care to keep, the heads of the stalks laid all the same way. This system is economical of labor, because it requires the cutters to cross the field but once in cutting two rows, and the picker to cross the field but once to collect the product from four rows. On a large plantation, a foreman, or overseer, should watch the cutters at their work to see that the crop is cut thoroughly. No stalk of whatever size should be allowed to grow to any height during the cutting season, for this has a tendency to check the production of new stalks—the marketable part of

the plant. The only exception to this rule would be where some stalks are reserved for the production of seed or where they are used as lure plants.

24. In some instances asparagus cutters are supplied with strong, flat baskets, such as that shown in Fig. 11, that will hold from 8 to 10 pounds of stalks; the shoots should be placed in these baskets with the tips in the center, in order to prevent injuring the most prominent part of the marketable product. Sometimes a  $\frac{1}{2}$ -bushel peach basket is used for this purpose, as shown in Fig. 8. In such a basket the shoots should be placed butts down to prevent injury to the tips.

When a basket becomes filled it is left in the field for another man to take to the packing house. A low cart is convenient for this purpose.

This plan of cutting and gathering up baskets of asparagus has both its advantages and disadvantages. In most instances,

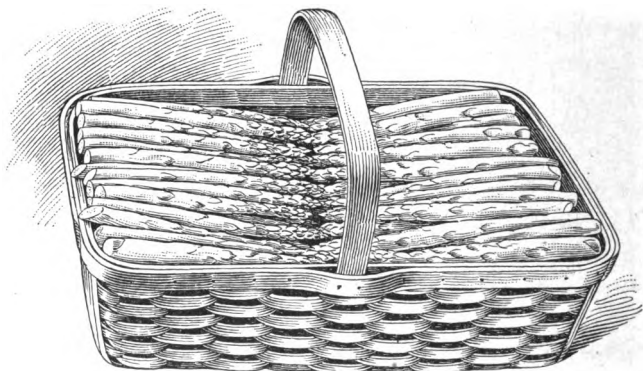


FIG. 11

the shoots thus handled will be less dirty than those laid in the rows, but frequently time will be lost by the cutters running out of baskets, and rarely can the cutters be made to lay the shoots in the baskets all one way; when the shoots are not laid in the baskets all one way extra labor will be required in the packing shed to do this. The cost of cutting, picking up, and carrying asparagus to the packing shed should not exceed  $1\frac{1}{2}$  cents a bunch if the work is well supervised.

## MARKETING

### PREPARATION FOR MARKET

**25.** The asparagus shoots are taken from the field direct to the packing shed, where they are prepared for market. This preparation includes washing, grading, bunching, trimming, and packing.

**26. Washing.**—Only in exceptional cases will asparagus be clean enough as it comes from the field so that washing will not be necessary. Cleanliness adds much to the appearance of the product in the market. Two plans are followed in washing asparagus: Washing it before bunching, and washing it after bunching. Washing the shoots before they are bunched is the more satisfactory way. The work can be done much more thoroughly than when the shoots are bunched, and bunching and tying the washed shoots is much pleasanter work than bunching dirty shoots. The washing is commonly done in tubs. Running water is an advantage.

**27. Grading.**—Asparagus is graded according to the size of the stalks, and the grading of this vegetable is a much more important matter than the grading of almost any other vegetable. Three grades are usually made, namely, **extra**, or giant, **prime**, or first, and **second**; a fourth grade called **cull** is sometimes made. The importance of maintaining these grades depends on the market supplied. To obtain the most money for a crop in the

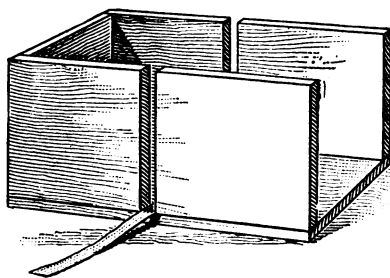


FIG. 12

wholesale market, a strict adherence to the first three grades is necessary. When a retail trade is supplied the grades are not so essential; in some retail markets, a better average price can be obtained by selling asparagus mixed rather than graded.

**28. Bunching.**—After the shoots are washed and graded they are bunched. Various devices may be used to facilitate the work of bunching. A home-made asparagus bunching box is shown in Fig. 12. This consists of a small box from 4 to 4½ inches in width and height, and from 6 to 9 inches long, according to whether it is intended for white or green asparagus.

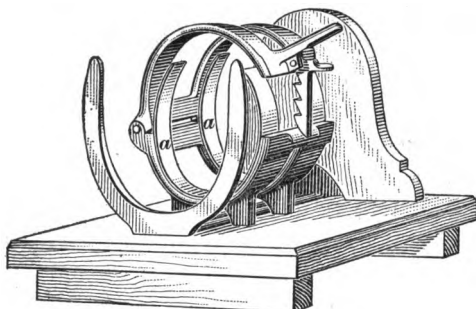


FIG. 13

This box is open at the top and at one end, and has a slot through both sides for holding one of the tapes or strands of raffia with which the bundle of shoots is to be tied. After tying this one the bundle is lifted out of the box and the

other tied in place; the bunch then appears as shown in Fig. 16. If desired, two slots might be made in the sides of the box, and all the tying done before the bunch is removed. More elaborate kinds of home-made asparagus bunchers may be built, but they seldom answer the purpose any better unless constructed like some of the manufactured kinds. Asparagus bunchers are so inexpensive that it seldom pays to use the less convenient home-made kinds.

**29.** One of the earlier types of improved asparagus bunchers, the Acme, is shown in Fig. 13. This buncher is still used by a large number of extensive asparagus growers, in spite of the fact that other machines that are easier of operation are on the market. The asparagus shoots are placed in the machine until it is fairly well filled, and then pressure is applied to the top to compress the stalks during tying. To remove the bunch, it must either be drawn out of the end, or the four ends of the spring bands *a* that almost completely encircle the bunch must be held back with the hands while the bunch is being lifted out, or the outside stalks will be scratched and injured.

30. An improvement on the Acme, known as the Philadelphia buncher, is shown in Fig. 14. The hinge part *a* of this machine is so constructed that the spring bands *b* are required only on one side. This leaves the opening at the top sufficiently wide that the bunch can be readily lifted out as soon as the top is thrown back. The handle *c* is a late improvement that has been added for the purpose of making it easier for the operator to apply pressure to the bunch; as originally made the pressure had to be applied by pressing on the top of the machine. The latch hook *d* holds the top down firmly while the bunch is being tied. The end *e* and the knife guard *f* are made adjustable.

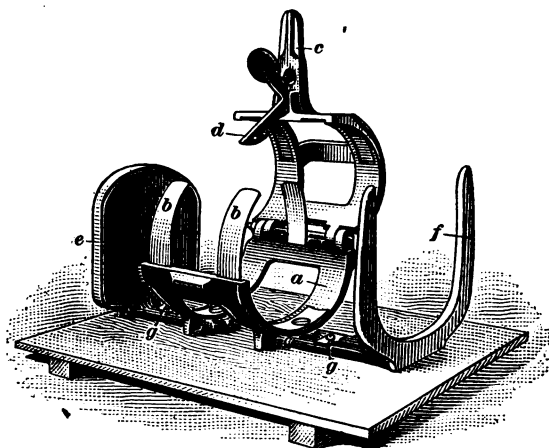


FIG. 14

to accommodate bunches of different lengths, and their positions are controlled by the screws *g*. The whole device is mounted on a small platform so that it can be conveniently handled. After the bunch is locked in the machine and tied, a large sharp knife is run down the face of the knife guard *f* and the ends of the stalks in the bunch are trimmed off cleanly, as shown in Fig. 15. These machines are made in several different sizes.

31. Large asparagus growers frequently have a number of machines of this type in the packing shed, and have a corps of trained operators, each of whom does only part of the bunching

The first operator places the stalks in the buncher and clamps the top down. The second operator adjusts the tape and ties the bunches. The third operator trims off the butts of the stalks. These three operators are usually on a slightly elevated platform, and the third operator sends the buncher, with the bunch of asparagus in it, sliding down an inclined plane, known as a *slide board*, to the packing table. Here the packer releases the latch hook, removes the bunch, and places the bunch directly in the shipping crate. The buncher is then returned by a boy to the first operator of the bunching crew. This system of rotation in the packing shed does away with a great deal of unnecessary handling of the asparagus, because,

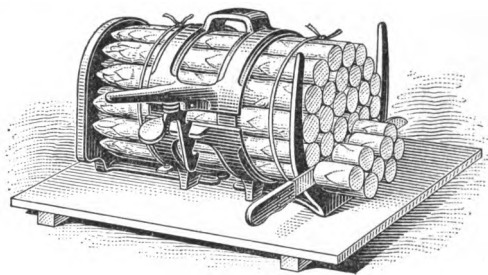


FIG. 15

for the greater part of the journey, the stalks are protected from bruises by the buncher and very few hands come in actual contact with it.

**32.** A bunch of asparagus is variable in weight and size. In some markets a bunch should weigh about 1 pound; in other markets a weight of  $1\frac{1}{4}$  to 2 pounds is required; and in still other markets a weight of not less than  $2\frac{1}{2}$  pounds is required. Such variations, of course, make a big difference in the revenue received for a crop if the price per bunch remains the same. Bunches vary in length from 6 to 11 or 12 inches, and in diameter from 3 to  $4\frac{1}{2}$  inches. The number of shoots in a bunch will vary from 1 dozen to 2 or 3 dozen; a crop that will average eighteen stalks to a large bunch is exceptional. The larger and heavier bunches are preferred on the Eastern markets.

The variation in the length of bunches is due to the different conditions existing in various parts of the country. In the Southern states the asparagus shoots are often allowed to develop to a greater height than elsewhere, and the bunches are from 11 to 12 inches long. In the New Jersey, Pennsylvania, Delaware, and Maryland asparagus districts the bunches are from 7 to 9 inches long, and in Massachusetts and Connecticut the bunches average about 9 inches in length, two bunches spanning a bushel box, and are the smallest in diameter.

**33.** The tying of asparagus is a very important item in the work of bunching. Unless the tying is well and properly done the bunches will not look their best in the market, may become loose, and, if they do become loose the shoots will probably be somewhat damaged.

Strong red tape from  $\frac{1}{4}$  to  $\frac{3}{8}$  inch wide, is usually the most satisfactory material for tying the bunches. The red tape against the green or the white of the asparagus looks attractive, and the tape usually holds the bunches firmly together. Raffia and strong jute string are used for tying bunches, but they are not so attractive and detract from rather than add to the appearance of the product. A bunch of asparagus should be tied firmly near the top and near the bottom with tape, as shown in Fig. 16. When tied around

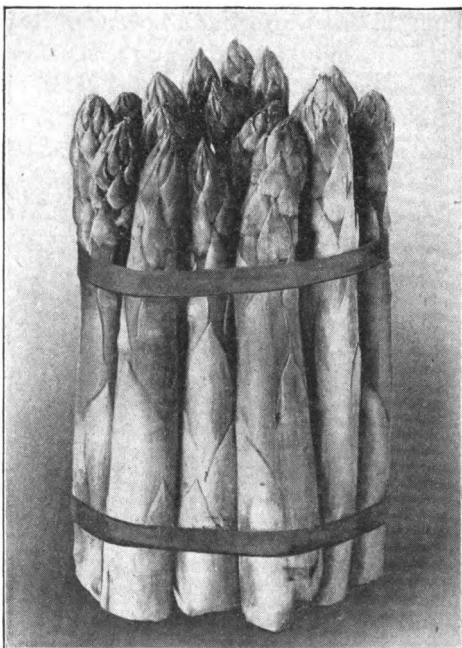


FIG. 16

the center with a single tape or piece of raffia a bunch will not carry well.

Heavy rubber bands have been advocated for holding asparagus stalks in bunches, but they are much more expensive than tape or raffia and when bunching machines are used cannot be conveniently applied.

**34.** A convenient device for cutting tape, twine, or other tying material into the proper lengths for tying asparagus and other vegetables that require bunching is shown in Fig. 17. This device is simple and can easily be made at home. A piece of board *a* about 18 inches long, 6 inches wide, and 1 inch thick should be selected, and holes, *b*, *c*, *d*, *e*, *f*, *g*, etc., should be bored in it large enough to hold the pegs *h* and *i*; usually such holes should be about  $\frac{1}{2}$  inch or a little more in diameter. The hole *b* should be bored about 3 inches from one end of the

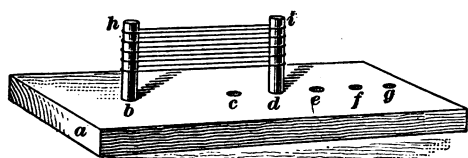


FIG. 17

board and the hole *c* about  $4\frac{1}{2}$  inches from *b*; this will allow lengths of tape or string about 10 inches long to be cut, which will be about the shortest lengths that will be required. The holes *c*, *d*, *e*, *f*, and *g* should be evenly spaced at any desired distance apart, usually about 1 inch. The pegs *h* and *i* should be made of hard wood and should be about 7 inches long so that when inserted in the holes they will stick up about 6 inches or a little more. These pegs should be made of a size that will fit snugly in the holes. The peg *h* should be made stationary with a little glue, but the peg *i* should be movable.

Tape or twine may be cut rapidly by means of this device. If lengths about 12 inches long are desired, the peg *i* should be put in the hole *d*, which will be about  $5\frac{1}{2}$  inches from the peg *h*. The tape or twine should then be wrapped around the two pegs the required number of times, or until the space is filled, and a sharp knife run along one of the pegs cutting the tying material off clean; a sharp knife is essential to good work.

Ties of different lengths can be made by placing the peg *i* in different holes. Ties cut in this way can be more easily handled if a small rubber band is slipped over one of the cut ends of the bunch as it comes from the pegs.

**35. Packing.**—Asparagus is packed in a great variety of packages. The bulk of the crop is packed in a motley array of boxes, crates, and barrels; second-hand peach carriers, second-hand berry crates, potato crates, bushel boxes, and small barrels are among the packages used. Few of such packages add to the appearance of the asparagus, and hence their use is not a good business practice. The asparagus that brings the highest prices is packed in crates or boxes made especially for the purpose, different types of packages being used in different parts of the country.

**36.** New Jersey growers pack their asparagus in two forms of crates. The more common type of crate is shown in Fig. 18; this is narrower at the top than at the bottom, and is so constructed to prevent the bunches from becoming misplaced and bruised by rough handling in transit. The inside dimensions of this crate are: Length,  $23\frac{1}{2}$  inches; width at the bot-

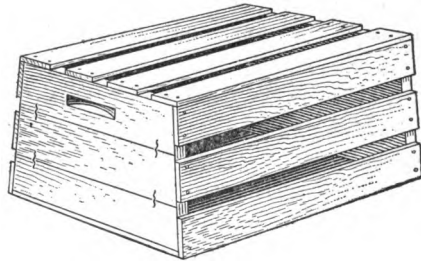


FIG. 18

tom,  $17\frac{1}{2}$  inches; width at the top, 15 inches; depth,  $11\frac{1}{2}$  inches. This contains about 4,392 cubic inches, or about 2 bushels. The ends are made of  $\frac{7}{8}$ -inch wood, usually composed of three small pieces of board, each a little less than 4 inches wide, held together with small wave-shaped iron fasteners, as shown in the illustration; this construction permits of the using of scraps of lumber that might otherwise be wasted. The slats are made of  $\frac{3}{4}$ -inch material and are a little less than 3 inches wide. Asparagus crates of this type already made up with the slats left off one side, as shown in Fig. 19, sometimes cost as much as 24 to 25 cents each in lots of one hundred or less, but the

average price for these crates over a number of years has been about 20 cents; when sold in the flat they usually cost from 1 to 2 cents less. This crate will hold from twenty-four to thirty bunches of asparagus that weigh from 2 to 3 pounds each, or an average of  $2\frac{1}{2}$  pounds, and that have a diameter of 4 to

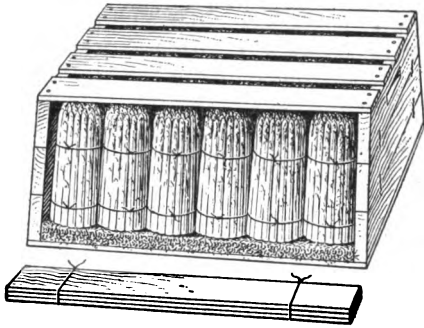


FIG. 19

$4\frac{1}{2}$  inches and a length of 8 to 9 inches, or a little more. When packed, such a crate and contents will weigh about 65 to 75 pounds. The bottom of the crate is not slatted but is made fairly tight. A layer of damp sphagnum moss is placed on the bottom of the crate, and the

bunches are stood upright on this with the cut ends down; so packed the asparagus will keep fresh for a long time. The slats are left off of one side so that the crate can be packed from the side, as shown in Fig. 19, and the bunches made firm so that they will not joggle about in transit; these slats are nailed on as soon as the crate is filled, and the package is then ready for shipment.

The other type of New Jersey crate is shown in Fig. 20. This crate is also used for tomatoes. The inside measurements of this crate are as follows: Length,  $18\frac{1}{2}$  inches; width, 11 inches, and depth, 9 inches. The ends are made of  $\frac{7}{8}$ -inch wood braced inside with  $\frac{3}{8}$ -in. by 1 in. corner posts; the ends have hand grooves in them to assist in handling the crates. The slats are made of  $\frac{3}{8}$ -inch wood and are a little less than 3 inches wide. Strips 1 in.  $\times$  1 in. are nailed along the bottom on each side of the crate, and the lid, which is composed of two slats, is raised about 1 inch above the rest of the top. When stacked one on

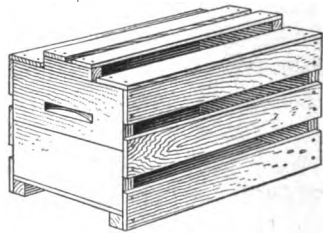


FIG. 20

top of the other, these bottom cleats and the raised lid interlock and prevent the crates from moving about. This crate is supposed to hold 1 dozen bunches. Originally, this crate was built much larger and would hold  $6\frac{1}{2}$  pecks, or more than  $1\frac{1}{2}$  bushels, or about 3,494 cubic inches. When made according to the dimensions previously given, however, it will hold only about 1,803 cubic inches, or only a little more than  $\frac{3}{4}$  bushel, and thus will hold only about one-half as much as the original crate of this type. The bushel in this case is considered to be 2,150.42 cubic inches. An average price for this crate at its present size is about 12 cents each in lots of 100, with the lid  $1\frac{1}{2}$  cents extra.

On account of the high price of these crates due to the high price of lumber, many growers are complaining that a cheaper crate than either of the preceding should be devised.

37. New England asparagus growers largely use for asparagus the solid bushel box shown in Fig. 21. The dimensions of this box are: Length, 18 inches; width, 18 inches; depth, 8 inches. About 2 to 3 dozen of the smaller bunches of asparagus, weighing 1 pound or a little more, are usually packed in this box. The bunches are laid flat and with the tips toward the middle. If the bunches were packed upright the tips would become bruised and broken. Sometimes the stalks are packed loose in the box without bunching.

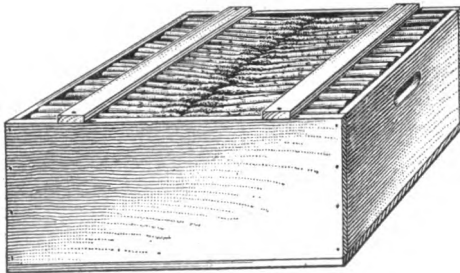


FIG. 21

38. The California asparagus growers use a crate similar to that now used by the New Jersey growers, but the California crate was probably the first of the type, as it was originated by W. E. Meek about 1900. The California crate, shown in Fig. 22, is somewhat smaller and of somewhat lighter material than the New Jersey crate. The dimensions, inside measurement,

as measured on the crate shown in the illustration, are: Length, 18 inches; width at bottom, 11 inches; width at top,  $9\frac{1}{2}$  inches; and depth,  $10\frac{1}{4}$  inches. This makes the cubic contents about 1,891 cubic inches, or a little less than 1 bushel, or considerably less than one-half the size of the New Jersey crate. The end pieces of the crate are  $\frac{5}{8}$ -inch boards, the partition is a  $\frac{1}{2}$ -inch board, and the bottom, side, and top slats are made of  $\frac{3}{16}$ -inch lumber. The bottom was originally made in one piece, but two pieces are now largely used; when two are used they should be placed close together to hold the  $\frac{1}{4}$  inch of damp moss that is placed in the bottom of the crate. On each side one 3-inch strip is nailed close to the bottom of the crate, and another is nailed on the side about  $1\frac{1}{2}$  inches from the top. The top is composed of two slats 4 inches wide that are nailed

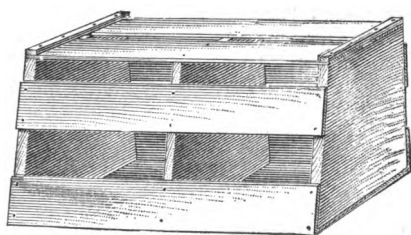


FIG. 22

down at the ends with  $\frac{5}{8}$  in. by  $\frac{5}{16}$ -in. cleats. This package is intended to hold about 28 pounds of asparagus, or 1 dozen bunches of from  $2\frac{1}{4}$  to  $2\frac{1}{2}$  pounds each.

In the case of some of the most fancy asparagus, California growers will

wrap each bunch in oil paper before packing it in the crate, in order to prevent the evaporation of moisture and to retard wilting. As previously mentioned, damp sphagnum moss is usually placed in the bottom of the crate. A label is usually pasted on one, or, preferably, on both ends of the crate; labeling is a paying practice for all growers to follow, provided their product is first class. Such a label should contain the name of the shipper and the place from which the shipment is made.

**39.** The Southern asparagus growers use a slatted crate, similar to the New Jersey crate shown in Fig. 18. The dimensions of the crate are: Length, 28 inches; width at top,  $14\frac{1}{2}$  inches; width at bottom, 19 inches; depth, 12 inches. The end pieces are  $\frac{7}{8}$ -inch lumber, the slats  $\frac{3}{8}$ -inch lumber  $4\frac{1}{2}$  inches wide, and the crate holds about thirty  $4\frac{1}{2}$ -inch bunches.

40. A convenient hamper that is used to advantage in marketing asparagus locally is shown in Fig. 23. This hamper will hold about six bunches. It is too expensive for a gift

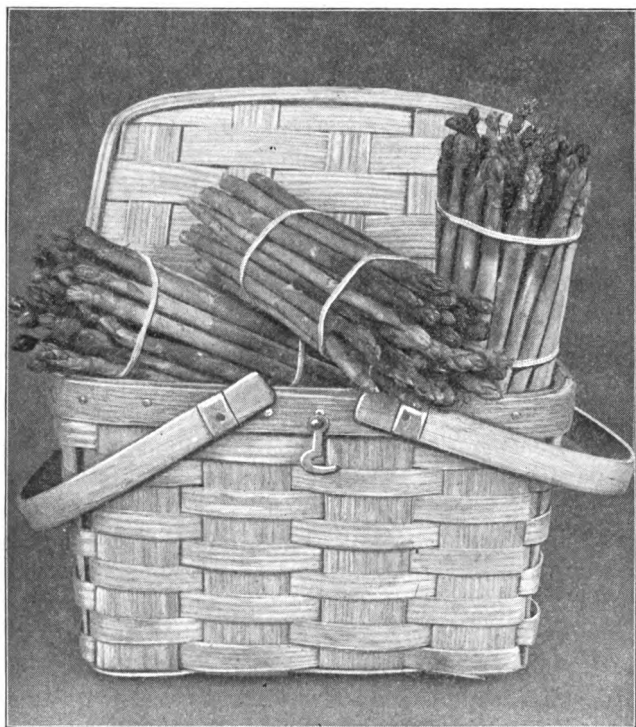


FIG. 23

package, and is gathered up again from stores after the product is sold. This hamper may also be used for other vegetables later in the season.

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#### PRICES OF ASPARAGUS

41. The demand for asparagus is so great that the prices are uniformly good, and usually only when the asparagus is of poor quality or is injured because of poor packing does the product bring low prices. The fact that the crop is not especially perishable, that is, can be kept without deterioration for several

days, especially when the butts of the bunches are stood in water, has an important influence on the prevention of temporary gluts and low prices in the markets. Asparagus is commonly sold by the dozen bunches, although early in the spring and sometimes in November and December, when little asparagus is offered for sale and the prices are especially high, the bunch is made the unit of sale. Up to the present time, it is doubtful whether the size of the main asparagus crop from year to year has had more than a moderate influence on the price—at least of recent years the range of quotations in the New York markets are fairly uniform except during 1906 and 1907, when prices were abnormally high. Sometimes a cold, late spring will reduce the crop early in the spring and boost prices.

In the New York wholesale markets asparagus is sold by the dozen bunches almost entirely, the bunches averaging from 2 to 2½ pounds in weight. In other markets, bunches as light as 1 pound are sold.

An examination of the detailed fluctuations of the average wholesale prices per dozen bunches of asparagus in the New York wholesale markets for the 10 years from 1903 to 1912, inclusive, show variations of several hundred per cent. in the same month and from month to month. The prices in the New York markets are considered because the largest quantity of asparagus in the country is handled through this center, the vegetable often being reshipped from this point to the smaller markets. Hence, in some local markets that are canvassed directly, higher prices can often be secured than in the New York markets.

**42.** In the New York markets, as well as elsewhere, the highest prices are naturally secured for asparagus when the quantity in the markets is smallest, that is, in the winter and in the early spring. In February and March, when the supply is limited, the top-notch prices are secured; the high average prices secured in February are due to the fact that very little is offered for sale. The prices begin to decline about the latter part of March, although they are frequently very satisfactory after that, until the lowest prices are received in June and July. Only a small

quantity is offered for sale in August, and the prices are, on an average, somewhat higher. During November and December only a limited quantity is offered, but at fairly good prices. Table I shows the extreme low and high prices and the average low and high prices in each month both by the dozen bunches and by the single bunch in the New York wholesale markets for the 10 years from 1903 to 1912, inclusive. These prices are

**TABLE I**  
**PRICES OF ASPARAGUS IN THE NEW YORK MARKETS**

Month	Per Dozen Bunches				Per Bunch			
	Extreme Prices		Average Prices		Extreme Prices		Average Prices	
	Low	High	Low	High	Low	High	Low	High
January . . . .								
February . . .	\$10.00	\$15.00	\$10.00	\$15.00	\$0.50	\$2.00	\$.50	\$2.00
March . . . . .	2.00	24.00	3.05	14.66	.35	2.00	.35	2.00
April . . . . .	1.00	11.00	1.25	7.00				
May . . . . .	.50	14.00	.70	6.15				
June . . . . .	.40	5.00	.68	3.45				
July . . . . .	.37	5.00	.56	3.15				
August . . . .	1.25	4.00	1.63	3.13				
September . .								
October . . . .								
November . . .	4.00	6.00	4.00	6.00	.35	1.00	.35	1.00
December . . .	4.00	6.00	4.00	6.00	1.00	2.00	1.00	2.00

figured from the average low and high prices on the first and fifteenth of each month for the 10 years in question. The prices per dozen bunches in February, November, and December are figured on quotations in only one month of the 10 years and the same is true of all the prices per bunch.

Asparagus is found in the market continuously during March, April, May, June, and July, and is found there intermittently

during February, August, November, and December. During January, September, and October no asparagus was quoted in the New York markets for the 10 years indicated. That sold during November and December is largely forced, as is also some of that sold during February and March.

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#### STORAGE, DRYING, AND CANNING

**43. Storage.**—Asparagus is seldom stored in the ordinary sense of the word, but it may be held for a number of days without deteriorating by standing the bunches in about  $\frac{1}{2}$  inch of water. In this way the low prices attendant on a temporary glut in the market may be avoided. As mentioned elsewhere, this is often practiced in holding over for the Monday market asparagus that has been cut late Saturday afternoon. Asparagus shoots when placed in water will usually take up considerable water, making the bunches tight, and the shoots will also usually grow a trifle longer.

**44. Drying.**—Asparagus may be readily dried and the large shoots used for serving whole during the winter, and the smaller ones used for soups and sauces. Usually, the largest stalks are canned and the medium and small stalks are dried. To be successful, the drying must be thoroughly done, for if much moisture is allowed to remain in the stalks, decay and deterioration are likely to be rapid. The drying is a simple matter. A large needle threaded with heavy linen thread, or with a thin twine, is passed through the butt ends of the stalks and they are hung up along the sunny side of a house. More than one day may be required to complete the drying, in which case the strings of partially dried stalks should be removed to the inside of the house for the night and kept dry. After the stalks are satisfactorily dried they should be placed in a clean, porous bag that will not impart any taste to the vegetable and kept in a cool, dry place until wanted.

The stalks can be brought back to a soft, succulent state by keeping them in water slightly below the boiling point for several minutes. The hard outside skin should be removed and then cooked until done, which will require but a short time.

**45. Canning.**—In this country, the principal centers of the asparagus canning industry are in California and on Long Island, and the canned product of these sections can be found on the market the year round. In Austria, Germany, Sweden, and France large quantities of asparagus are canned, and it is a popular dish; the canned product is not well known in Great Britain, but it seems to be gradually gaining a foothold. The greater part of all asparagus that is canned consists of white stalks. In 1909, a total of 229,742 cases of asparagus, valued at \$1,975,775, were canned in the United States. The total value of this product is about 10 per cent. as large as the tomato and about 20 per cent. as large as the sweet corn crops canned in the same year. The canning industry has greatly extended the culture of asparagus, and has made this vegetable a profitable crop in some localities where it could not be readily shipped to market in a fresh condition. The prices paid at the canneries for bunches about  $7\frac{1}{2}$  inches long and weighing  $2\frac{1}{2}$  pounds are about \$14 a hundred bunches for the best grade and about \$7 a hundred bunches for stalks of the second grade.

**46.** The canning of asparagus in a factory is a business apart from farming and will not be discussed here; it requires a large capital and much special knowledge. The canning of asparagus for home use, however, is simple. Many farmers can the cull stalks and the small shoots that are broken off in leveling up the field after the cutting season is over.

The following method of canning asparagus is recommended by the United States Department of Agriculture:

"Cut the asparagus the length of a fruit jar, pack the jar closely, fill with cold water, add a little salt, and put the lid on loosely. Place these jars in hot water reaching to the brim, and boil for 3 hours, adding enough hot water to that in the jars to keep them full. Close the lids tightly and set the jars away to cool."

To prepare the contents of a jar or a can for the table, simply open the receptacle, pour off the liquid, and heat the shoots for a few minutes in boiling water. They can then be served with a sauce.



# RHUBARB, ARTICHOKES, AND SEA KALE

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## RHUBARB

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### GENERAL REMARKS

1. **Rhubarb**, or *pie plant*, is next in importance to asparagus among the commercial perennial vegetable crops. It is an herbaceous perennial and belongs to the same family as buckwheat and the common dock. Rhubarb has been cultivated for nearly 5,000 years. Its native home is in China, but little or no improvement was ever made in the plant in that country. Its first marked improvement occurred in Russia, where it was at first largely grown for the roots, which were used for medicinal purposes. Rhubarb was first cultivated for its leaf stalks in the 16th century, when it began to be a crop of some importance in England and in Europe generally.

Rhubarb is now grown almost entirely for its leaf stalks, or petioles, which are used in making pies, tarts, and sauce, usually at times when fresh fruits are not plentiful. The roots for medicinal purposes are now commonly secured from the wild plants.

2. In most home gardens and on many commercial vegetable farms, rhubarb is a popular crop. But, because of the perennial nature of the plant and the fact that it more or less completely monopolizes the ground on which it is planted, many market gardeners do not attempt its cultivation. The crop is best adapted for growth on comparatively inexpensive

land and in a location where the product can be harvested early and carried to market with little expense. The culture of rhubarb is simple, but, as in the case of asparagus, the expense of starting a plantation is considerable.

3. The principal factors that have an influence on success in rhubarb culture are: (1) the selection of good roots for setting from the best stock available; (2) the proper setting of the roots on land that is well adapted to the crop; (3) the application of an abundant supply of the most suitable manures and fertilizers; (4) good cultivation; (5) care in keeping the seed stalks pulled off before they weaken the energies of the plant; and (6) care in harvesting.

4. **Commercial Importance.**—The rhubarb crop is of secondary commercial importance in the United States, although in some localities it is a very profitable crop. According to the census, the total value of the crop produced in the United States in 1909 was \$338,831, raised on 2,364 acres, distributed among 1,021 farms; this is an average of 2.31 acres per farm. These figures include only the crop grown in patches of 1 acre or more; large quantities are grown in smaller patches.

Rhubarb is produced commercially in about three-fifths of the states in the country. The ten principal states, ranking in the order of the value of the crop produced, are: California, Illinois, New York, New Jersey, Massachusetts, Pennsylvania, Ohio, Washington, Kansas, and Michigan. These states produce about 88 per cent. of the total crop; California alone produces about 23 per cent.

5. The average income per acre from rhubarb in the United States is about \$101. The average income in many of the states is much higher than this, although there is a wide variation. The approximate average income per acre in the principal states is: Massachusetts, \$367; Pennsylvania, \$198; New York, \$196; Washington, \$184; Ohio, \$174; Kansas, \$165; Michigan, \$137; New Jersey, \$134; California, \$117; and Illinois, \$92. In Massachusetts considerable attention is given to growing this crop, and the market demand for it is good.

**6. Cost of Production and Income.**—The cost of production per acre of rhubarb must be considered from the point of view of the cost over a number of years, because the returns for the early life of a plantation are much out of proportion to the expenses; conversely, the difference between running expenses and receipts in the later years is not all net profit, because the heavy expense of the first year must be taken into account. When properly handled, a rhubarb plantation should pay for the running expenses, or a little better in the second year, and growers who succeed in getting an exceptionally vigorous growth of the plants should get a large enough return from the plantation by the end of the third year to pay for all of the expenses up to that time. A detailed account of the expenses, receipts, and net expenses per acre for 3 years on a market-garden rhubarb plantation is as follows:

<i>Expenses:</i>	FIRST YEAR	MODERATE ESTIMATE	LIBERAL ESTIMATE
Interest on investment at 5 per cent. (land valued at \$200 per acre).....		\$ 10.00	\$ 10.00
Plowing and harrowing.....		6.00	8.00
Stable manure, 20 to 30 tons at \$2....		40.00	60.00
Commercial fertilizer, about 1,000 pounds of a 7-6-5 mixture .....		14.00	18.00
Plowing out furrows for roots.....		2.00	2.00
Roots, about 3,230 when set 4½ feet by 3 feet, at 2 to 3 cents each.....		65.00	97.00
Labor of setting.....		6.00	10.00
Cultivation, four to six times.....		6.00	12.00
Harvesting and marketing, at ¼ cent per pound.....			10.00
Total.....		\$149.00	\$227.00

*Receipts:*

The yield the first year will vary from nothing to as much as 2 tons. At 1½ cents a pound, this would give..			
			60.00
<i>Net expense</i> .....		\$149.00	\$167.00

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<i>Expenses:</i>	SECOND YEAR	MODERATE ESTIMATE	LIBERAL ESTIMATE
Interest on investment.....		\$18.00	\$19.50
Stable manure, about 10 tons.....		20.00	20.00
Commercial fertilizer, about 1,000 pounds.....		14.00	18.00
Cultivation.....		5.00	10.00
Harvesting and marketing, at $\frac{1}{4}$ cent per pound.....		10.00	30.00
Total.....		<u>\$67.00</u>	<u>\$97.50</u>

## *Receipts:*

The yield will vary from 2 to 6 tons.

At  $1\frac{1}{2}$  cents a pound, this would give

	60.00	180.00
<i>Net expense</i> for second year.....	\$ 7.00	
<i>Net profit</i> for second year.....		\$ 82.50
<i>Net expense</i> for 2 years.....	\$156.00	\$ 84.50

NOTE.—The net expense for the two years, in the case of the moderate estimate, is found by adding the net expense, or loss, for both years; in the case of the liberal estimate, the net expense is found by subtracting the net profit for the second year from the net loss of the first year.

<i>Expenses:</i>	THIRD YEAR	MODERATE ESTIMATE	LIBERAL ESTIMATE
Interest on investment, about.....		\$19.00	\$ 15.00
Stable manure and commercial fertil- izer .....		34.00	38.00
Cultivation.....		5.00	10.00
Harvesting and marketing, at $\frac{1}{2}$ cent per pound.....		24.00	48.00
Total.....		<u>\$82.00</u>	<u>\$111.00</u>

## *Receipts:*

The yield will vary from 6 to 12 tons.

At  $1\frac{1}{2}$  cents a pound, this would give

	\$180.00	\$360.00
<i>Net profit</i> for third year.....	\$98.00	\$249.00
<i>Net expense</i> for 3 years.....	\$58.00	
<i>Net profit</i> for 3 years.....		\$164.50

NOTE.—The net expense for the three years, in the case of the moderate estimate, is found by subtracting the net profit for the third year from the net expense of the second year. The net profit for the three years, in the case of the liberal estimate, is found by subtracting the net loss for the first two years from the net profit for the third year.

7. Many items in this estimate vary in different localities, such as the interest on the investment, because of variations in the value of land, cost of manures and fertilizer, cost of harvesting and marketing, etc.

The cost of harvesting and marketing is decreased from  $\frac{1}{4}$  cent to  $\frac{1}{8}$  cent a pound in the third year because of the larger quantity, which can be handled at a less cost per unit.

Some growers may criticize the estimated average selling price of  $1\frac{1}{2}$  cents a pound as being too high, but it is obtained in many places. In certain sections growers sell their first pullings of stalks for about 6 cents a pound, and do not get less than 2 cents a pound during the season.

The gross income of \$360 for the liberal estimate in the third year is by no means exceptional. One prominent New Jersey grower who always has from 4 to 8 acres in this crop frequently secures a gross return of \$500 per acre.

8. A rhubarb bed that is well cared for should bear well for from 5 to 8 years. No definite limit can be set. A rhubarb plantation can be profitably worked as long as the crowns produce enough stalks large enough to be readily marketable.

**9. Climatic Requirements.**—Rhubarb roots are hardy and will withstand the winters in practically all parts of the United States. The leaves are killed by severe cold, but, except in unusual cases, the roots will be uninjured and will produce another crop of foliage in the spring. In order to protect the roots during the winter, some growers apply a mulch of manure, straw, etc. over the rows. This is unnecessary to prevent injury from winter killing, but if manure is applied as a mulch considerable plant-food is added to the soil. Any mulch should be taken off before growth starts in the spring.

**10. Soils.**—The best soil for rhubarb is a deep, rich, moist, well-drained sandy loam soil. It should be mellow and fertile to a depth of 6 to 8 inches. A soil with a high subsoil, or a soil underlaid with hardpan should be carefully avoided; in a shallow soil the roots do not have room to develop and are

not able to become large and strong enough to mature large crops early in the spring. In spite of its preference for a soil possessing the characteristics just described, rhubarb will do fairly well on almost any kind of soil that is put in a good condition of tilth. When it is to be produced commercially as an important crop on the farm, however, only the best soil should be selected.

Rhubarb is a heavy feeder and requires large quantities of water to develop its large stems and leaves quickly. If a soil is not well supplied with water naturally, irrigation will prove very beneficial.

Rhubarb proves most profitable on a warm soil that has a southern exposure. This is due to the fact that such a soil will warm up quickly in the spring and tend to hasten the early development of the rhubarb foliage. Hastening of maturity a few days may mean double profits.

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## VARIETIES AND PROPAGATION

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### VARIETIES

11. There has been a lack of interest in varieties of rhubarb, due partly to the fact that it is generally known that rhubarb does not come true to seed and partly to the fact that the plant is generally propagated by root cuttings. There are, however, a number of named varieties. The best of these are the *Linnaeus*, *Victoria*, *St. Martins*, and *Mammoth*.

12. The *Linnaeus* rhubarb, a plant of which is shown in Fig. 1, has been more widely planted than any other variety, because of its earliness, color, and excellent edible qualities. It does not produce as heavily as some of the others, but when it is heavily fertilized and receives good cultivation it will produce satisfactory crops. The stalks are of an attractive pink color, have a tender skin, and crisp flesh of a fine flavor.

13. The *Victoria* rhubarb ranks second in the area planted. It is a few days later than *Linnaeus*, grows a leaf stalk about

one-third larger, is more decidedly green, and has a somewhat tougher skin. The quality of the leaf stalks, however, is good and the variety is popular for a midseason sort. Some of the improved strains of the Victoria are early and highly colored. Although not of as good quality as Linnæus, these strains of the Victoria are rapidly coming into favor with commercial growers.



FIG. 1

14. The **St. Martins** rhubarb is listed by some of the leading seed firms, but it is doubtful whether it is worthy of much attention. It is later than Linnæus, the leaf stalks are not so highly colored, nor are they of more than average quality. The plants are, however, heavy yielders.

15. The **Mammoth** rhubarb develops a late crop. The leaf stalks are very large, coarse, green, and, when allowed to reach their full development, weigh several pounds each. For ordinary market purposes, this variety is of little value.

**PROPAGATION**

16. Rhubarb may be propagated by root division and by seed. Propagation by root division is by far the most common method and the only one used to any extent commercially. Under favorable conditions, a piece of root containing a strong eye will produce a good plant in one season's growth, although the stalks will not be ready for cutting until the second season, and a full crop should not be cut until the third season. A root may be cut into as many pieces as there are good eyes, but it is a better practice to leave two eyes to a piece, and as much as possible of the root should be allowed to remain attached in each seed piece; the first part of the growth of the new plant is supported by the plant-food stored up in the root, and the greater the supply of food in the root the stronger will be the growth.

Growers who make a practice of forcing rhubarb during the winter, either in hotbeds or in special houses, commonly dig the roots for forcing from an old plantation in the fall, cut off enough eyes to start a new plantation in the spring, and then force the remainder of the large fleshy roots during the winter.

17. Rhubarb may be readily propagated from seed sown either under glass or in a seed-bed in the open. There are, however, two important disadvantages connected with propagation from seed: (1) The plants from seed vary widely, only a comparatively small percentage coming true to the original plant from which the seed was taken. (2) Plants grown from seed require 1 year longer for growth before marketable stalks can be cut from them, and this seriously increases the cost of production and defers the securing of an income from the ground. When roots are grown from seed they must be carefully inspected, and all those that do not show the proper characteristics should be discarded. Roots for forcing are sometimes grown from seed.

When rhubarb is propagated from seed, the seed is commonly sown in a seed-bed, and the plants are grown in this for 1 year

before they are transplanted to their permanent places. In this way space is economized and there is an opportunity to sort out and discard all inferior plants at transplanting time.

The seed is commonly sown in drills about 18 inches apart, or even somewhat closer on valuable land, and after the young plants are 2 or 3 inches high they are thinned to stand from 6 to 8 inches apart in the row.

Rhubarb seed cannot be readily sown by all seed drills because of its peculiar shape and light weight; a seed sower with a force feed and with a large opening for the escape of the seed, however, will do the work.

18. Rhubarb seed is large but light in weight, due to the fin-like attachments on it. About 1,500 seeds weigh 1 ounce, and 1 quart weighs about 3 to 5 ounces. A sample of Linnaeus rhubarb seed is shown natural size in Fig. 2.



FIG. 2

When kept under ideal conditions, rhubarb seed is fairly long-lived, the average life being about 3 years, and the extreme limit of germination is about 8 years. For practical results, however, rhubarb seed should be of the previous year's growth and should have been well cured and kept. At best its viability, or germinating power, is low, and although the older seed may germinate, the growth of the seedlings is not likely to be vigorous enough to insure success. To be considered of high grade, rhubarb seed should be 99 per cent. pure, and about from 65 to 75 per cent. of it should germinate. The seedlings, however, do not come true to the characteristics of their parents; about 75 per cent. commonly show a tendency to degenerate; from a commercial point of view, not more than 15 per cent. of the seedlings are likely to be valuable. The seed is rather slow to germinate; about 14 to 21 days are

usually required for this process. Rhubarb seedlings are shown natural size in Fig. 3.



FIG. 3

19. When planted at the common distances, from 3 to 5 pounds of rhubarb seed are required to sow 1 acre, and from 1 to 3 ounces to sow about 100 feet of row. Rhubarb seed

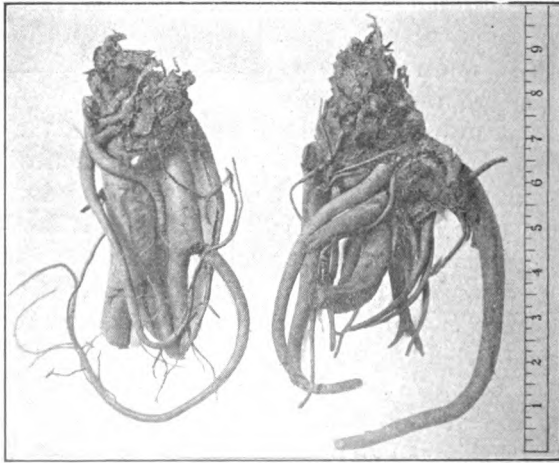


FIG. 4

is not expensive. Reliable seedhouses retail it at about \$1.25 a pound in pound lots.

20. Rhubarb roots for planting are commonly offered for sale from October 1 to May 1. They are rather expensive to buy, as they cost from \$25 to \$50 a 1,000. Good roots for planting are shown in Fig. 4.

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## PLANTING AND GENERAL OPERATIONS

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### PLANTING

21. Fall planting both of rhubarb roots and seedlings is practiced by many growers, but, on an average, better results will be secured from spring planting, especially in northern localities. The planting should, however, be done early in the spring so that the plants will have time to make a good growth the first season. In warm sections, fall planting is uniformly successful.

The first step in preparing the soil for rhubarb culture is to plow under about 25 tons of manure in the fall previous to planting, as explained in the discussion of fertilization. If no manure is available, the plowing should be done in the fall just the same. The ground should be deeply harrowed with a disk harrow as early in the spring as it can be worked, and then the harrowing finished with an Acme or a spike-tooth harrow.

The distances for planting vary with the fertility of the land. Commercially, rhubarb is planted either 3 feet by  $4\frac{1}{2}$  feet or 4 feet by  $4\frac{1}{2}$  feet; in small patches it can sometimes to advantage be planted 2 feet by 4 feet. When planted 3 feet by  $4\frac{1}{2}$  feet, about 3,230 hills can be set per acre; at 4 feet by  $4\frac{1}{2}$  feet, about 2,420 hills; and at 2 feet by 4 feet, about 5,445 hills.

Immediately after the harrowing is completed, the land should be furrowed out about 6 to 8 inches deep, the furrows being run with their centers about  $4\frac{1}{2}$  feet apart across the field. If the field has a sharp slope in any direction, the furrows should be run at right angles to the grade; if the field is on a hillside the rows should follow the contour at the base of the hill; this will to some extent prevent washing of the soil.

The bottom of the furrows should be covered with a good coating of manure, which should in turn be covered with from 2 to 3 inches of soil, and then the manure and the loose soil mixed together. In setting the roots, a hole is commonly made with a spade in the bottom of the furrow just deep enough to provide room for the root. Before each piece of root is set it should be examined to see that it has at least two good eyes. Each piece of root should then be set in the hole and covered with from 2 to 3 inches of soil. If this does not entirely fill up the trench, the remainder of the depression can be filled up gradually during cultivation.

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#### CULTIVATION

**22.** The rhubarb plant requires large quantities of water to make a good growth, and frequent and thorough cultivation is essential to conserve all the moisture possible. The first spring, cultivation should begin soon after the root pieces are set in the field and should be repeated frequently enough during the season to maintain a dust mulch and to keep down the weeds. During the first season of growth, the cultivator teeth should be run to a depth of 3 or 4 inches, in order to force the rhubarb plants to develop a deep root system, which will better enable them to withstand drought in later seasons.

The first cultivation the second and succeeding springs should be fairly deep, because, as described later, it is customary to apply a mulch of manure to the crop the previous fall, and this should be thoroughly mixed with the upper few inches of soil. The later cultivations, however, should be shallow, or more damage than good may result.

The first season, rhubarb is often intercropped with snap beans or some similar crop, planted midway between the rows. But many growers object to this on the ground that the companion crop interferes with the cultivation, and that the yield from a rhubarb bed which has been intercropped the first season will not be so heavy in later years as that from one which has not been so handled. At all events, no intercropping should be attempted after the first year.

#### CUTTING OUT SEED STALKS

**23.** The production of seed is a great drain on the strength of the rhubarb plant. On a commercial plantation, it is more profitable to send this strength into the production of marketable leaf stalks, and in storing up energy in the fleshy roots for future use, rather than into the production of useless seed. For this reason, cutting or breaking off the seed stalks is a regular part of the work of rhubarb culture.

Normally, the rhubarb plant sends up seed stalks freely during the summer. This seed-stalk growth occurs earlier if the plant is overtaxed by too severe harvesting or is weakened by unfavorable soil conditions.

Rhubarb seed stalks should not be cut out until they have grown to a height of from 18 inches to 2 feet. If they are cut out shorter than this, side stalks are sure to develop close to the crown, and the work of cutting these side stalks out is very tedious. The seed stalks should not be pulled off of the crown like the leaf stalks, but should be cut off with a sharp knife close to the crown. It is ordinarily necessary to go over a field three or four times during a season to keep down the growth of seed stalks. At no time should the stalks be allowed to develop on a commercial plantation to the point where the seeds begin to mature.

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#### FERTILIZATION

**24.** The fertilization of rhubarb should be carefully attended to, because it has an important influence on the gross returns and the net profit that can be secured from this crop. The following points should be considered: (1) A quick growth of the rhubarb plant will produce the growth of large, brittle stalks that will sell for much higher prices than small or tough stalks. (2) The stalks that can be harvested early in the season bring much higher prices than those harvested later. (3) The quantity and quality of the stalks produced in any given spring depend to a large extent on the fertilization and care given to the plants during the growing

season of the preceding year. (4) The rhubarb plant always grows most luxuriantly in soils that are abundantly supplied with humus.

Stable manure is particularly valuable on rhubarb because it furnishes both humus and plant-food and aids in conserving moisture for the use of the plant. The most successful growers manure their ground heavily for 1 or 2 years previous to the time of planting it with rhubarb. The fall before setting the roots, about 25 tons or more of stable manure should be plowed under, and in the spring a good coating of manure should be applied in the trenches before the roots are set; preferably, the manure in the trenches should be well rotted. Cattle manure will give fully as good, if not better, results with rhubarb than horse manure. After the rhubarb plantation has been started, annual applications up to 25 tons of manure per acre will produce good results. The best time to apply it is in the fall, because it then has time to work down into the soil and decompose to a certain extent. Spring applications, however, are better than none at all.

25. Many commercial growers do not apply any commercial fertilizer to rhubarb after they have made liberal application of stable manure, but experience has shown that commercial fertilizers produce profitable results. When judiciously applied they greatly assist in the quick growth that is so essential to success with this crop.

Successful growers apply about 1,000 pounds per acre of commercial fertilizer early in the spring and mix it thoroughly with the upper few inches of soil at the time of the first cultivation. This fertilizer commonly contains 7 per cent. of nitrogen, 6 per cent. of phosphoric acid, and 5 per cent. of potash. In addition to this, fractional applications of from 150 to 200 pounds of nitrate of soda along the rows during the growing season are usually productive of good results. These are made at intervals of 2 or 3 weeks, as recommended for asparagus. The application of a top dressing of about 200 pounds of nitrate of soda to the rhubarb plantation at the close of the harvesting season is also important, as this will stimulate the development

of the entire plant and build up strong roots from which the following year's crop is to be developed.

26. When properly fertilized and taken care of generally, a rhubarb bed will bear crops for many years. There is a limit, however, to the time the yield from a commercial plantation will be profitable; beyond this time it is more advisable to renew a plantation than to retain an old one. The period of profitable bearing is variously estimated to be from 5 to 8 years, but the average probably is somewhere about 5 years.

#### METHODS OF HASTENING EARLINESS OF CROP

27. Because the best prices are secured only for the first rhubarb stalks that are sent to market, the grower makes every effort to stimulate his crop to begin growth early in the spring. The most common method of stimulating an early growth in the spring is to apply a heavy mulch of manure over the ground in the fall before the ground has frozen. This will prevent the frost from penetrating very deep in the ground, and consequently will greatly shorten the time in which the ground will thaw out and warm up in the spring. Some growers go a step further and build a small bank of hot manure over each row in the spring. This is allowed to remain for a couple of weeks, by which time the ground underneath will be fairly well warmed up; the manure is then removed from the rows and usually taken from the field, although it is sometimes worked into the soil between the rows.

When the crop is grown on a small scale, half barrels or kegs are sometimes set over the hills and hot manure banked around the outside. The ground is warmed up and an early growth stimulated by this means, but when the plants are grown in a partial shade in this way there is a natural tendency for the leaf stalks to lengthen out in order to reach the top of the barrel where the foliage will have light, and the result is spindling stalks.

A few growers have even placed steam pipes in trenches between the rhubarb rows and run steam through them to

heat up the soil early in the spring. This has met with success in some instances, but the practice is rather expensive, and only a few growers have the facilities for it or feel that the results warrant the expense.

28. The method of increasing the earliness of the crop that is practiced by a Wisconsin rhubarb grower is worthy of careful study, as it has proved very effective and may be applied with certain modifications to many other conditions. In the fall he plows a furrow close to the south side of each row, the soil being thrown to the north, directly on top of the row. In this way the crowns of the plants are protected during the winter by an extra covering of soil, and more ground surface is exposed to the sun; this is an important point late in the winter and early in the spring when there are usually many warm days. In the spring the sun warms up the south side of this bank of soil and draws the frost out early. As soon as it is possible to plow, this open furrow on the south side of each row is half filled with coarse, strawy manure, and a furrow slice is thrown back on top of this manure by running a plow through the bank on top of the row. By this operation a small furrow is left nearly directly over the row. This is then partly filled with manure, and then all of the surface of the soil is worked level with a shallow-working smoothing harrow. By means of the manure the soil next to the row is still further heated, stimulating a quick growth of the plants.

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#### INSECT PESTS AND INJURIES

29. Insect pests and fungus diseases are so seldom injurious to rhubarb that they are of little practical importance. Commercial growers never take any special pains to avoid loss from them. If the plants are kept growing vigorously the loss from these causes will never be noticeable; plants that lack vigor, however, will sometimes suffer.

Occasionally, mice are a serious pest in a rhubarb field, particularly if they are present in large numbers when the roots are first put in the ground. They may eat many of the

newly set roots. There is no effective way of combating these pests other than by distributing bait covered with rat poison along the rows. Fortunately, the commercial grower seldom has to contend with them.

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## HARVESTING AND MARKETING

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### HARVESTING

30. Only a small crop of rhubarb should be harvested the first and second seasons. The spring of the third season of growth a fair-sized crop may be pulled. After the third year, or beginning with the fourth season of growth, a full crop may be harvested.

Rhubarb is harvested by pulling the leaf stalks from the crown of the plant. The harvesting commonly begins when the largest of the leaf stalks are from 6 to 10 inches long. As the season advances the market demands longer stalks, and late in the season the length should be from 18 to 24 inches. In times of short supply the market will take shorter stalks than when the supply is plentiful. The common practice is to harvest the stalks from the plants about once a week and to take the largest stalks from each plant. Early in the season when prices are high all but three or four of the stalks are pulled. Frequently, as many as a dozen stalks are pulled from one plant, and sometimes more; the weaker the plant the fewer the number of stalks that should be harvested from it. If rhubarb is to be harvested throughout the season from the same plants more leaves should be left on the plants than when the pulling is done only in the spring.

Like the asparagus plant, the rhubarb plant requires time for recuperation. It is unusual to continue the harvesting from a young plantation after the middle of June in the latitude of New York City. The leaves that are formed after that time are allowed to develop to their fullest extent and to die on the plant. The food elaborated in these leaves is thus largely returned to the roots and stored there for the production

of other leaves early the following spring. If these leaves are not allowed to develop properly, sufficient food will not be stored up in the roots, the crop of the following spring will be lessened both in quantity and in quality, and, when badly mistreated in this respect, the roots will be permanently injured.

The fact that there is some demand for rhubarb late in the summer, however, sometimes makes it advisable to harvest some stalks later than the middle of June. In the case of an old plantation many more stalks can be taken off than in the case of a young plantation. Judgment must be exercised in harvesting late. The grower who has an extensive acreage of rhubarb and who commonly renews a part of it at a time, can supply the late demand to best advantage. He can most profitably continue to harvest stalks throughout the summer from the old roots that are to be taken up and thrown away at the end of the summer or in the fall.

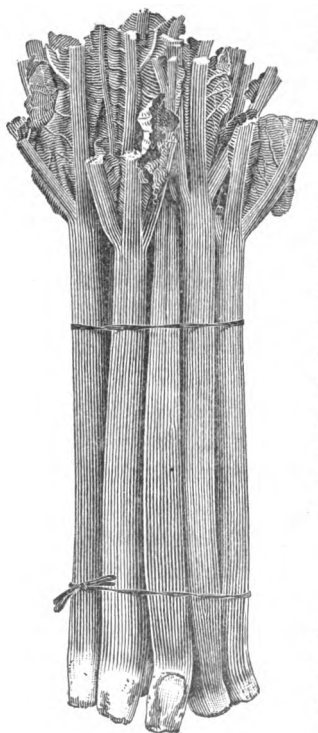


FIG. 5

markets demand much larger bunches, sometimes as large as 25 to 30 pounds. Red or blue tape is preferred for tying because it adds to the attractiveness of the bunches; common string, is, however, often used.

A bunch of rhubarb with the leaves cut to within about 2 inches of the stalks is shown in Fig. 5.

32. In Fig. 6 is shown the Sax-Mayer vegetable tying machine, which is suitable for tying rhubarb in bunches; this machine is also used for tying in bunches a large number of vegetables, such as beets, carrots, salsify, radishes, bunching onions, asparagus, etc. One operator on such a machine will do the work of about six tying by hand.

This machine works very much like a sewing machine, and

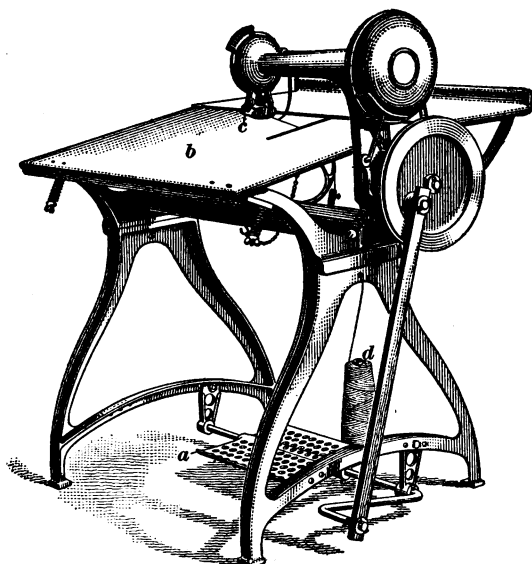


FIG. 6

may be operated by foot power by the treadle *a* or by an electric motor. The table *b* is made of galvanized iron and the working parts of the tying device *c* are made of bronze, so that they will stand up well under moisture. The tying material comes from the spool *d*, and the speed with which the machine ties vegetables depends largely on the skill and quickness of the operator. The tying parts are quickly adjustable to bunches of different sizes.

## MARKETING

33. During the latter part of the spring and the early part of the summer rhubarb meets with an active demand in most markets. The highest prices are received early in the season, that is, before and during April; they show a sudden drop in May and a still further decline until August, when

TABLE I  
PRICES OF RHUBARB IN THE NEW YORK MARKETS

Month	Per Hundred Bunches			
	Extreme Prices		Average Prices	
	Low	High	Low	High
January.....				
February.....	*†\$1.00	\$2.00		
March.....	† 1.00	6.00	†\$2.00	\$4.00
April.....	1.00	6.00	2.21	4.50
May.....	.25	4.50	.72	2.75
June.....	.25	3.00	.73	1.50
July.....	.25	2.00	.75	1.29
August.....	1.00	2.00	1.25	1.63
September.....	*1.50	2.00		
October.....	*1.50	2.00		
November.....	*1.50	2.00		
December.....				

\*Only once in the 10-year period were there quotations in this month.  
†Per case.

they show some improvement. During the fall months rhubarb is in light supply in the larger markets.

Table I shows the monthly low and high extreme and average prices per hundred bunches of rhubarb (usually weighing 1 pound each) in the New York wholesale markets for the 10 years from 1903 to 1912, inclusive. These prices are based on the average of the low and high prices on the first and fifteenth of each

month for the 10 years. They very clearly indicate that the best returns from rhubarb can be secured only early in the season.

In the New York wholesale markets rhubarb is commonly sold by the 100 bunches, the bunches varying in weight from 1 to 3 pounds, according to the time of the year, the lighter bunches being sold early in the season. During the late winter and early spring rhubarb is largely sold also by the case in these markets; the capacity of these cases is not uniform, but they seldom hold more than 100 pounds.

In many local markets the price of the outdoor-grown crop of rhubarb ranges from about  $\frac{1}{2}$  cent to 6 cents a pound. The forced crop brings much higher prices.

Within recent years, the extensive production of rhubarb on a large scale that has been undertaken in many favorable localities in the North, West, and South has resulted in greatly increasing the supply in the markets, and prices rarely run as high as they did from 10 to 20 years ago.

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#### FORCING OF RHUBARB

**34.** The production of rhubarb indoors during the winter has developed into an extensive business within the last few years, especially in the vicinity of some of the larger cities; the method of doing this is called the *new rhubarb culture*. From one small New England town shipments of more than 200 tons of forced rhubarb to the Boston market have been reported in a single season, extending from December 1 to April 1. The demand for forced rhubarb has increased very rapidly, perhaps even faster than the supply, and this product has now become almost as stable as any of the out-of-season vegetables in the large markets. The production of forced rhubarb is particularly attractive to the commercial vegetable grower who needs some kind of work to keep help employed during the winter.

**35. Production of Roots.**—The forcing of rhubarb is possible because of the habit of the rhubarb plant of growing a thick, fleshy root in which sufficient plant-food is stored

to produce a large growth of stalks when the root is placed under suitable conditions, regardless of the time of year. In this respect the rhubarb plant is very similar to the asparagus plant, although the appearance of the roots of the two plants is not similar. When grown in the common way under suitable conditions in the field, the rhubarb plant makes a very vigorous growth during the spring and summer, stores up food in the root during this process, and then develops the first stalks in the spring from this stored-up food. When the roots are forced, the natural course of the plant is merely hastened so that stalks can be produced when they can be sold for high prices.

Probably the most important factor in successful rhubarb forcing is to secure an annual supply of suitable roots. A good root for this purpose should be not less than 3 years old, should have been grown in good soil, and should show a healthy development. The age of the roots above 3 years is not important, provided they are vigorous and healthy; sometimes, however, older roots will be more vigorous and will produce better results. Frequently, old rhubarb roots are used for forcing when an old rhubarb bed is to be discontinued; the larger the clumps of roots, the better suited they are for forcing purposes, provided they are solid and healthy. If, however, rhubarb roots are to be regularly produced for forcing, roots older than 3 years will be too expensive to produce.

When rhubarb forcing is not an annual practice, little attention is paid to the production or to the source of the roots for forcing. Any roots that happen to be available are used at odd times. When, however, a market has been worked up for forced rhubarb, and a supply must be produced with regularity to hold customers, it is essential to grow roots in the field in sufficient quantity to produce enough roots to cover the floors of the forcing rooms twice during the winter season.

**36.** Three methods of systematically producing rhubarb roots for forcing are by: (1) renewing roots that have been previously forced; (2) growing roots from root cuttings; and (3) growing roots from seed.

**37.** The renewal of rhubarb roots that have already been forced is accomplished by dividing the clumps of roots into pieces containing from two to four good eyes, setting these in the field, fertilizing them heavily, and giving them good general culture for 2 or 3 years until they have developed to suitable size and strength to again withstand the strain of forcing. The advantages commonly claimed for this method of producing rhubarb roots for forcing are that: (1) it is economical of labor; the best of the roots that are removed from the forcing place are simply divided at this time and set in the ground, where they are allowed to grow for two seasons; (2) it is unnecessary to buy new stock to keep up the supply of roots; (3) it is unnecessary to destroy the exhausted roots, or at least not more than part of them; this is sometimes a troublesome task.

**38.** When rhubarb roots for forcing are to be grown from root cuttings, a large plantation of rhubarb must be kept constantly on hand. This must be large enough so that each year enough roots can be taken up, divided, and replanted to supply the clumps of roots that will be needed for forcing 2 years later. Each of these lots for future forcing should be set in separate patches so that they can be conveniently taken up together. Then, after the roots are once forced, they are usually thrown in the compost pile or disposed of in some other way. The divided roots need to be planted in very rich soil and to be properly cared for for 2 years after resetting. The advantages claimed for this method of producing rhubarb roots for forcing are that: (1) superior root clumps are produced; (2) larger crops of forced stalks can be produced from the larger roots; and (3) the method of securing a supply is more systematic, as there is always some uncertainty about the satisfactory growth of forced roots that are reset.

**39.** In the production of rhubarb roots for forcing from seed, the fact that rhubarb does not come true to the variety characteristics from seed makes comparatively little difference, because the conditions under which the crop is grown largely influence quality. There are no great differences between

varieties, and the exceptional conditions under which rhubarb is grown in forcing tend to overcome these small variations.

Sometimes rhubarb seed for the production of roots for forcing are planted early in pots in hotbeds, etc., and then the seedlings are transplanted to the field. More often, however, the seed is sown directly in the field. As previously mentioned, the seed is slow to germinate, the period of germination being from 14 to 21 days, but after the plant once becomes well established it grows vigorously. The culture is the same as for roots in a permanent plantation, except that they may be allowed to stand somewhat closer together in the row.

Some growers advocate the use of 1-year-old rhubarb roots for forcing. At this age the roots should be from 6 to 8 inches long, about 1 inch thick at the crown, and should have from three to five well-defined buds. If, however, the roots can be grown in the field where they have plenty of room to develop, and are supplied with an abundance of moisture and plant-food, it is better to grow them for at least 2 years. When 2 years old, a rhubarb root should be from 9 to 10 inches long, from 3 to 4 inches in diameter at the crown, and have from six to ten good-sized, healthy buds. Roots 3 years old will be proportionately larger and more productive.

**40. Place for Forcing.**—The essential requirements for rhubarb forcing are simple. Rhubarb may be successfully forced in any place where the roots can be packed in 3 or 4 inches of soil and covered with about 1 to 2 inches over the crowns; where they can be watered abundantly; where there is at least 18 inches of headroom to allow for the development of the stalks; and where the temperature can be controlled at will. Light is not essential. In fact, most growers purposely exclude all light, because when grown in the dark the leaf of the plant grows a beautiful, golden-yellow color, and is very small, and the stem has a handsome pink color. When grown in the dark, however, all rhubarb lacks, to a certain degree, the firmness and flavor of that grown in the light. The lack of firmness necessitates careful handling. Many persons prefer the more delicate flavor of rhubarb grown in the dark.

Houses or pits may be specially constructed for rhubarb forcing, so that the conditions previously mentioned can be maintained to the greatest perfection. Such houses need no windows, except perhaps a few to admit light for the workmen. They should be solidly built so that changes in the weather conditions outdoors will not greatly affect the temperature inside. And they should be equipped with some artificial heating system, such as steam or hot water. Sufficient head-room, of course, should be allowed so that the workmen will not have to stoop.

The greater part of the forced rhubarb crop, however, is not grown in specially constructed houses. A dwelling-house cellar, even one with a cement floor, can be used for this purpose. Barn cellars, vegetable storage pits, and specially constructed vegetable storage houses, such as celery storage houses, are often used for rhubarb forcing when they are not needed for other purposes. Unoccupied spaces under greenhouse benches are commonly used for this purpose. Some greenhouse growers also utilize odd spaces at the ends of the houses, or in boiler rooms, etc.

**41. Time for Forcing Rhubarb.**—There is an active and growing demand for forced rhubarb during the winter months. The first sales can be made about December 1, but the first active buying usually occurs in Northern markets about Christmas time, and from that time on there is a more or less steady demand until February or March, when the demand becomes very active and continues so until the outdoor-grown crop comes into the market.

The time for starting the forcing of rhubarb roots naturally varies with the time when the marketable stalks will be most in demand. Varying somewhat with the temperature and moisture conditions maintained, marketable stalks can be harvested in from 3 to 8 weeks from the time the roots are placed in the forcing place. The rate of growth and the length of time that one set of roots will continue to produce marketable stalks will vary partly according to the temperature and moisture conditions and partly according to their natural vigor.

The time for setting a second lot of rhubarb roots in the forcing house depends on the strength of the first lot. A second lot should be set as soon as the first lot ceases to produce profitably. If good roots are used, not more than two lots will be needed for forcing during one winter season. In fact, roots that do not have vigor enough to stand forcing for from 6 to 8 weeks, will seldom produce large enough stalks to bring the best prices for a long enough time to make them profitable.

**42. Heat for Forcing.**—When rhubarb is forced on a very small scale, as where only a few square feet of space are used in a dwelling-house cellar, heat can be very easily supplied. A convenient method is to partition or curtain off the space occupied by the rhubarb, and keep a couple of lanterns in it during the night or even during the day time, if the weather is very cold.

Oil stoves have been used with success in small forcing pits. A small wood stove or a small coal stove with a long stovepipe arranged so that the maximum quantity of heat will be given off from it, will usually supply enough heat for a forcing pit about 16 feet by 40 feet.

A small hot-water heater is frequently more satisfactory for a small forcing pit. Some of the hot-water heaters used to supply heat to very large incubators are suitable. Hot-water heaters that will do for a moderate-sized forcing pit can often be purchased second hand very cheaply.

If rhubarb is grown as the main crop in a greenhouse, the temperature may be readily regulated to suit it. Usually, however, rhubarb is a crop of only secondary importance in a greenhouse, being grown under benches, in bins, or on shelves, and the temperature is regulated to supply the needs of the main crop. Rhubarb is strong and rugged as compared with most greenhouse crops, and will do fairly well under conditions suitable for almost any other crop.

**43. Digging and Freezing the Roots Before Forcing.** To be in the best condition for forcing, rhubarb roots should be carefully dug and must be thoroughly frozen. They should not be dug until late in the fall, and when dug they should be taken out of the ground with the least possible injury.

One of the best plans for taking rhubarb roots out of the ground consists in plowing as close on one side of the rows as possible without injuring the crowns, and then tipping the crowns over into the open furrow by plowing along on the other side of the row, taking care to get the point of the plow well under the row; to prevent injury to the roots, the plowing must be carefully done and the roots must have been planted in straight rows. Workmen should follow immediately after the plow, take the roots out of the furrow, and commonly place them on top of the ridge to freeze.

44. Many experiments have demonstrated that the best results in rhubarb forcing can be obtained only when the roots are frozen before being placed in the forcing place. After being frozen and then thawed, rhubarb roots grow much more vigorously and send up larger stalks than if they are forced without being first frozen. Why this is so is not definitely known, but it is unquestionably a fact.

Preferably, some soil should adhere to rhubarb roots that are to be frozen for forcing. If they can be frozen on top of the ridges without further handling they will be less likely to be damaged than when handled unfrozen. If, however, the weather is so mild that the roots will not be frozen promptly after they are dug, they should be placed in an open shed where they can be protected somewhat from drying out, and should be left uncovered on cold nights.

As a general rule, rhubarb roots are placed in the forcing room immediately after they have been frozen in order to produce early stalks.

45. **Etherization.**—A stimulation of the growth of rhubarb roots for forcing similar to that produced by freezing has been secured by etherization. Etherization consists simply in holding the rhubarb roots for a number of hours in an atmosphere heavily impregnated with ether fumes. Experiments have shown that the time required is somewhere from 24 to 72 hours; but the results have varied so much that further work is necessary before the matter can be satisfactorily decided; growers who care to etherize their roots will do well

to experiment some on their own account. The etherization may be easily accomplished by placing the rhubarb roots in an air-tight box; usually they are placed on shelves so that the surface of the roots will be well exposed to the fumes. About 1 pint of liquid ether is necessary for each 1,000 cubic feet of air space in the box; the ether is merely set in the top of the box in a small pan and allowed to evaporate. After being properly etherized, rhubarb roots grow with considerable vigor, but so far this method has proved to be of little or no commercial value, largely because the same results can be secured by freezing at much less cost.

**46. Placing the Roots.**—The clumps of rhubarb roots should be placed closely together in the forcing room so that a maximum number can be set in a given space, due regard being paid to imbedding them properly in the soil and in arranging them so that the harvesting can be easily conducted.

If the roots are to be set on a concrete floor about 2 inches of soil should be placed on this before the roots are taken into the room. If there is an earth floor, no additional soil need be placed under the roots. If the roots are placed on benches, as in the greenhouse, about 2 inches of soil should be placed on the benches first, so that the roots will be protected from the air and may be more readily supplied with moisture.

The rhubarb roots should be set in beds of such a width that the product can be harvested without walking over the crowns. If the area set is extensive a system of paths throughout the beds is necessary; usually, the paths are made about 1 foot wide. If the beds are arranged along a wall, or for any other reason it is convenient to pick the stalks from one side only, 4 feet is a good width to make the beds. If the stalks can be picked from both sides, about 8 feet is a better width for the beds, because it is more economical of space and the harvesting can be done just as readily.

In setting the rhubarb roots in the bed care should be taken to keep uppermost the buds, from which the stalks will grow. After the clumps of roots have been packed closely together,

good soil should be spread over the crowns so that after it has been wet down it will be from 1 to 2 inches deep on top of the crowns.

**47. Management During Forcing.**—The management during forcing consists in watering the bed properly and in maintaining the proper temperature. Ample water should be supplied, but not enough to soak or waterlog the soil. Ordinarily, the soil should be watered whenever the surface appears to be dried out or when the growing stalks seem to be suffering for need of water. The water should preferably be applied in a fine spray.

The temperature should be regulated differently according to whether the grower desires to force his crop rapidly so that it can be quickly marketed, or whether he wishes to force it slowly so as to prolong the harvest over several weeks. When rhubarb is to be forced rapidly, a high temperature should be maintained, sometimes as high as 90° F. When a slow growth is required, it should be kept between 45° and 65° F.

The first growth of rhubarb stalks should appear through the 2-inch covering above the roots in from 1 to 3 weeks after the crowns have been set, according to the temperature which is maintained. The first stalks should be ready for harvesting in from 4 to 8 weeks after the roots have been set, and marketable stalks should continue to be produced for from 2 to 4 weeks.

**48. Harvesting and Marketing of Forced Rhubarb.** If the market price is high, forced rhubarb stalks may be harvested when they are about 8 inches long. At average prices, however, a somewhat better return will be secured if the stalks are allowed to grow from 12 to 14 inches long, as such stalks will weigh considerably more than 8-inch ones. Forced rhubarb stalks are shown in Fig. 7. The illustration shows the small leaf development.

Forced stalks must be carefully pulled, for two reasons: (1) they are brittle and if handled carelessly are likely to break and their market value will thus be reduced; (2) if care is not used in breaking away a marketable stalk, a bud capable of starting several stalks may be separated from the crown.

The preparation of most of the forced rhubarb for market consists merely in tying the stalks in bundles weighing 1, 2, or 5 pounds, according to the market demand. If the rhubarb has been forced in the dark, none of the foliage is trimmed off, but the small yellow leaves are left on the stalk as they grew. If the crop has been forced in the light, the large leaf on each stalk must be trimmed like that of the outdoor product.

The quality of rhubarb that has been forced in a moderately cool cellar is much better than that which has been forced

into unusually rapid growth by the maintenance of a temperature of from 75° to 90° F. When forced rhubarb is offered to customers in a local trade, the superior quality of slowly forced rhubarb can often be made a good talking point in making sales.

The yields of forced rhubarb will vary from 3 to 10 pounds per crown, according to the size, age, and vitality of the roots, and the temperature at which the forcing is conducted. The yield of rhubarb that is forced at a compara-



FIG. 7

tively low temperature is commonly greater than that which is forced at a high temperature. When 1- or 2-year-old rhubarb roots that have been produced from seed are used for forcing, a yield of less than 3 pounds per root is often secured.

**49.** The market price of forced rhubarb has varied widely. About 20 cents a pound has been secured for this product during times of scarcity in the winter, and prices as low as 4 and 5 cents have been secured for it in the spring, when it is brought into competition with the outdoor-grown crop. A fair average price for many large growers is 10 cents a pound, and at this price the crop will pay a fair profit.

An accurate estimate of the cost of production of forced rhubarb is difficult because of the great variations in the kinds of forcing rooms used and in the methods of handling. Most growers, however, figure that large clumps of roots should not cost them more than 15 cents each, whether they are grown or bought.

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## GLOBE ARTICHOKEs

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### GENERAL REMARKS

**50.** The **globe artichoke**, or *bur artichoke*, is a coarse-appearing, robust-growing perennial plant of the aster family; it is closely related to the cardoon and to the thistle. The first part of its scientific name *Cynara Scolymus* is from the Latin *cinere* (ashes), and the plant was so named because the Romans found that it grew exceptionally well in soil fertilized with wood ashes. The globe artichoke is a native of Southern Europe, especially of the country along the shores of the Mediterranean Sea. The Romans are the first people on record as having grown this plant.

At first glance the globe artichoke plant seems to resemble a large, overdeveloped thistle, but on close examination it is found to be much more beautiful. The plant is spreading in its habit of growth and reaches an extreme height of 3 to 5 feet. The leaves are large, growing from 3 to 4 feet tall, are deeply cut, and are covered with an ash-colored fuzz, or down.

The chief edible portion of the plant is the immature bud, or flower head, which is borne on the top of a stalk from 3 to 5 feet high; these buds grow from 3 to 6 inches in diameter, and somewhat resemble a small pineapple in general appearance; they are of good edible quality only up to the time the outer scales begin to open out. The edible parts of the flower head are the thick, fleshy, outer bud scales, and the bottom of the head on which the florets are borne. The young stems and leaves of the plant are also sometimes blanched

and eaten. All of the edible parts are eaten both raw and boiled and served as a salad; the half-grown buds are also pickled.

The globe artichoke is known to comparatively few persons in America, but it is worthy of greater attention. By many it is regarded as a great delicacy.

**51. Climatic Requirements.**—As the globe artichoke is a native of the warm climate of Southern Europe, it naturally succeeds best in the warmer sections of the United States, as in the South Atlantic and the Gulf-Coast States, and in California. When it has proper protection during the winter, however, it can be grown in almost all parts of the United States.

**52. Soils.**—The globe artichoke can be grown in any good garden soil. The plant will grow to its greatest perfection, however, only in the richest soils that are moist and well drained.

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## VARIETIES, SEED, AND PROPAGATION

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### VARIETIES

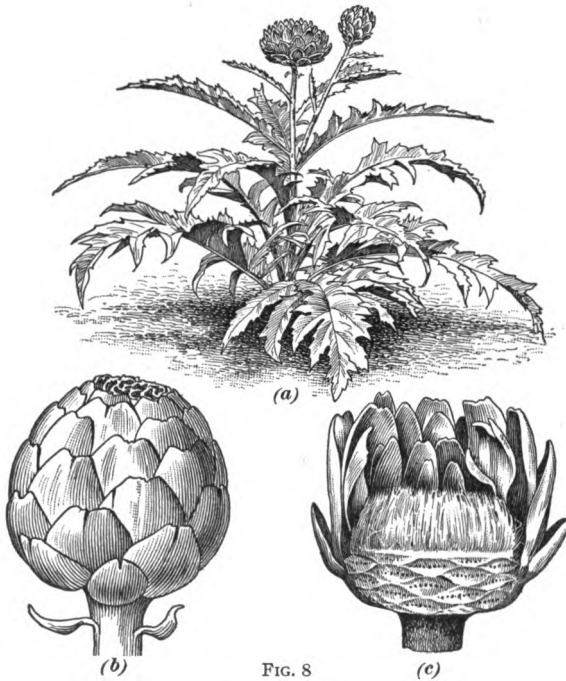
**53.** There are more than a score of varieties of globe artichokes on the market in Europe, but only three have been planted to any extent in the United States—the *Green Globe*, the *Green Oval*, and the *Purple*; of these, the first is the one most commonly listed by American seedsmen.

**54.** The *Green Globe* artichoke, illustrated in Fig. 8, is grown in many sections of the United States and is considered the standard in this country. In (a) is shown a small plant with two heads, the larger of which is too far developed to be suitable for eating; in (b) is shown a head at the proper stage for eating; (c) is a cross-section of a head showing the scales, the base, and the flower parts on the base underneath the scales. The scales are of a dull greenish purple, and they turn in somewhat at the top. The edible parts are somewhat

larger than those of the Green Oval and of the Purple, which largely accounts for the popularity of this variety.

**55.** The **Green Oval** artichoke has a somewhat conical or oval head. The scales are pointed and turn outwards. This is the hardiest of the three varieties.

**56.** The **Purple** artichoke is earlier than the Green Globe



and the Green Oval, but is not of such high quality. The scales of the heads are pointed and are tinted with purplish red toward their tips.

**57.** The **Large Green**, *French Globe*, or *Gros vert de Laon*, as it is called in France, is the most popular variety in the Paris markets. The heads grow to a considerably larger size than those of the Green Globe, and the edible part of the base of the scales is exceptionally thick and fleshy.

**58. Seed and Seed Production.**—Most of the globe artichoke seed used in the United States is grown in Europe, where this vegetable is extensively cultivated and where the climate is particularly suitable. By the exercise of a little care, however, artichoke seed can also be successfully produced in many of the southern parts of the United States; the climate of Southern California is well adapted to the production of artichoke seed.

**59.** The method of producing the seed is simple. A few of the finest heads on the best plants in a plantation should be allowed to develop and produce their flowers. During the time the flowers are developing, water should be prevented

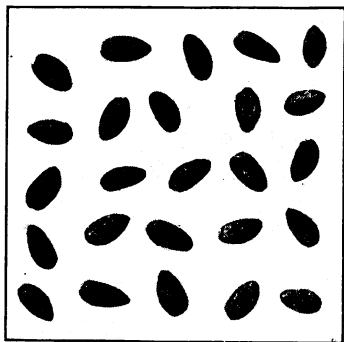


FIG. 9

from settling between the extended scales, because the excess of moisture will operate against successful pollination, and decay will be likely to set in. To accomplish this, the stalks should be bent over somewhat and held in this position by strings, which are tied just under the heads and fastened to stakes.

When the flower becomes withered up the seeds will be ripe and may be harvested. This is done by cutting off the seed receptacle and rubbing the seeds out of their casings. The seed should be well dried, placed in paper bags, and stored in a cool, dry place.

**60.** Artichoke seed is fairly large. About 846 weigh 1 ounce, and 1 quart weighs about 28 ounces. A sample of Green Globe artichoke seed is shown natural size in Fig. 9.

Artichoke seed is only moderately long lived. When kept under average conditions it will retain its power of germination for about 2 years; the extreme limit is about 5 years. Artichoke seed of good viability should produce about 600 good plants

to the ounce. The seed germinates in 7 to 14 days.— Artichoke seedlings are shown natural size in Fig. 10.

61. At the usual distances of planting, about 6 ounces

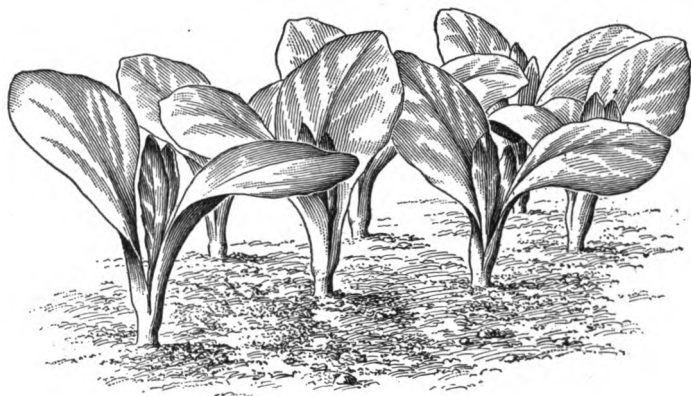


FIG. 10

of artichoke seed are required for producing plants enough to set 1 acre; and about 1 ounce is required to plant about 100 feet of row. Artichoke seed of good quality retails from seed houses at from \$3 to \$3.50 per pound in pound lots.

#### PROPAGATION

62. The globe artichoke is propagated by seeds, by suckers, or offshoots from the old roots, and by division of the roots.

In the United States, the plant is most commonly propagated from seed. The varieties do not come true to seed, and plants produced from seed grow heads that vary considerably in form. Propagating from seed is generally considered unsatisfactory and may be one of the reasons why the artichoke has not been more widely grown in this country.

In propagating from seed, the seed may be sown either in the open or in a hotbed or a cold frame, according to the climate.

When sown in the open, the seed should be put in the ground early in the spring, or about the time when the peach trees

are in full bloom. The plants from these seeds will be ready for transplanting to the field the following spring and will bear a crop that same season. The ground in the seed-bed should be very rich, and the seeds should be sown thinly in drills 1 to  $1\frac{1}{2}$  inches deep, and about 12 inches apart.

Larger plants can be secured early by sowing the seed under glass; in the latitude of New York City, this should be done early in March; a few edible heads can be secured from such plants the first year. Preferably, the seedlings should be transplanted into pots while under glass. After they have grown to a height of 8 to 12 inches in the pots they will be ready for transplanting to the field. The number of heads produced by such plants will be small the first year, unless the crop is being grown in the warmer parts of the country.

In propagating by suckers, the suckers should be taken off of the old plants early in the spring, with as many as possible of the fibrous roots attached. The soil should be pulled away from the old stools until the points from which the suckers spring are exposed. A good plant will produce from eight to twelve good suckers. Two or three of the best of these should be allowed to remain and the others may be slipped off. The slipping should be done when the leaves on the suckers are from 9 to 10 inches high; only shoots that are vigorous and free from blemishes should be taken for transplanting; imperfect shoots may be cut off and discarded or they may be allowed to develop if there is a possibility that they will produce marketable buds.

The suckers should be cut from the stool with a small piece of the old root adhering; this piece is commonly called a *heel*; it should be trimmed off smoothly without cutting off the fibrous roots. The large outside leaves should be removed from the suckers as soon as they are slipped, because if this is not done the large leaves will transpire so much water before the plant has time to establish itself that the future value of the plant will be greatly impaired. Artichoke suckers are greatly improved if the roots are placed in water for 3 or 4 hours before they are set in the ground.

By the use of suckers, the buds can be secured more quickly than when the plants are grown from seed, and the variety is more uniformly produced. Many persons produce their first plants from seed and continue the propagation by means of suckers.

The globe artichoke can also be propagated by means of root cuttings. Usually these are made from 4 to 6 inches long. This method, however, is not so good as the method of propagation from suckers, and is seldom practiced.

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## PLANTING AND GENERAL MANAGEMENT

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### PLANTING

**63.** The soil for globe artichokes should be as well prepared as for any garden crop. It should be well supplied with humus and deeply cultivated in order to allow the roots to penetrate it easily. The plants should be located so that they will have an open exposure and ample sunlight. If they are grown where they will be shaded by trees or where the drip from trees will fall on them, the plants will tend to grow spindling and the buds produced will be inferior.

The time for planting seed in the open and for setting out potted plants or suckers is about the same. The usual time for planting is as early in the spring as danger from frost is over; as previously mentioned, this is ordinarily about the time when peach trees are in full bloom; in some sections, however, peach blossoms are often nipped by the frost, and in these localities the planting of artichokes should be delayed until somewhat later.

As globe artichoke plants grow from 3 to 5 feet in height, throw out many branches, and develop leaves 3 feet in length, they should have ample space. Some growers recommend growing them from 3 to 5 feet each way. A system of planting that provides good space for cultivation and yet makes an economical use of the land is to grow the plants in rows 4 to 5 feet apart and to space the plants from 2 to 3 feet apart in the row; 2 feet by 4 feet will give about 5,445 plants per acre,

and 3 feet by 5 feet will give about 2,900 plants per acre. A few growers recommend making the rows 3 feet apart, and spacing the plants 2 feet apart in the row, making 7,260 plants per acre, but on most soils this spacing will be found much too close.

If the seeds are planted directly in the row in the field, they should be sown thinly and the plants thinned when they are from 4 to 6 inches high to stand the required distances apart.

Potted plants should be set at the required distances, at about the same depth they grew in the pots. They should be well watered after being set.

Suckers should be set the same as potted plants, except that the roots should be planted about 4 inches deep. Earth should be stamped about the roots, and the plants watered heavily. After the water has settled away, loose soil should be scattered over the surface. Where the sun is extremely bright some growers shade the sucker by sticking a board in the ground on the south side of the plant, and keeping the board there for several days until the plant becomes well established. Where the sun is hot, daily waterings for the first few days are also beneficial. The plants will usually grow without taking these precautions, but they do much better if they are so assisted in getting a good start.

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#### GENERAL MANAGEMENT

64. After planting and watering until the plants have become well established, about the only care required by artichoke plants during the summer of the first season is frequent cultivation. If the rows have been spaced wide enough this can be continued throughout the season with horse-drawn implements; it is a good idea to muzzle the horses to prevent them from eating the buds and leaves of the plants. Some hand hoeing between the plants in the rows may be necessary.

65. In the latitude of Georgia and in Southern California artichoke plants developed from potted plants and suckers

that are set very early in the spring will produce buds the first year from about June until October. The crops in succeeding years will be borne earlier, or from April until June or July. In the South, new plants are set out each year by those who wish to have a continuous supply of artichokes from early in the spring until the fall. In the latitude of New York City, few, if any, marketable buds will be produced the first year.

66. Although the globe artichoke is a perennial, the vigor of the plants and the yield of first-class buds greatly diminishes after the first full crop, which is usually harvested the second year of growth; the plants seem to be materially weakened after the first full crop and the buds produced are small and dry. Few growers count on getting more than two or three crops from a plantation, and the third one is seldom profitable. On a small scale, edible buds can be secured until the plants are about 5 years old, but not in sufficient numbers to make it pay. After a bed has outlived its usefulness, it should be promptly broken up, and a new one planted on a different site.

67. In localities where the ground freezes during the winter, artichokes should be mulched in the fall before the ground freezes. The old leaves should be cut away after the sap has run back from them into the roots, without injuring the center or side shoots. The most convenient material for mulching is coarse stable manure or straw, applied to a depth of 5 to 6 inches. If this is not available, a ridge of soil 4 to 5 inches high may be thrown up over the rows.

After danger from freezing is over late in the winter or early in the spring the mulch should be removed. This should be done before growth starts, or the new growth may be injured. Injury is particularly liable to result if a soil mulch is removed too late.

68. When the new shoots have attained a growth of 4 to 5 inches high in the spring the soil should be pulled back from about the stock of the plant until the source of the lowest shoot is exposed. All but two or three of these shoots should be removed, or the superabundance of shoots will cause the

production of a large number of inferior buds. Only the most vigorous looking shoots should be left. Care should be taken to allow those to remain that are lowest down on the stock. The thick, heavy, hard, woody stems that grow from the crown produce inferior buds. The good suckers that are removed may be used in starting new plants.

69. The quality and size of the buds can be improved in two ways: (1) If only the bud at the top of the main stalk is allowed to grow, all laterals being removed while they are young, this single bud will reach an extra-large size; commercially, this is never done, because the price received for the larger bud would not compensate for the loss of all the other buds. (2) A bud may be caused to grow larger than it otherwise would by tying a string tightly around the stem a short distance below the bud. This constriction is not made until the bud has attained nearly to marketable size. By compressing the sap vessels near the surface, the sap is retarded and sometimes largely prevented from flowing down to the roots while the vessels farther in the stem which carry the sap up are free to perform their natural function. This causes a backing up of the sap in the bud, more nourishment is retained there, and the growth is stimulated. The value of this method has not been thoroughly tested commercially, but it seems to have much better possibilities than the method of growing only one bud to a plant.

70. The globe artichoke will do well if fertilized like rhubarb. The ground should be well supplied with humus in order to hold the moisture; the humus supply can be augmented by the use of stable manure or of cover crops. Particular attention should be given to experimenting with larger applications of phosphoric acid and potash than those recommended for rhubarb. Unleached wood ashes are valuable for applying to ground planted to globe artichokes, principally because of the potash they contain. After a few trials, the quantities of these elements of plant-food that can be economically applied can be readily determined.

71. Insect pests and fungous diseases have not so far done any serious damage on the globe artichoke, and those growers who are producing it commercially do not make any effort to protect the plants from pests.

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### CHARDS, OR ARTICHOKE SALAD

72. Chards, or artichoke salad, consists of the bleached or blanched stems of the young shoots and the bleached young leaves of the artichoke plant; often only the fleshy midribs of the blanched young leaves are considered as chards. This product is similar to blanched cardoons and is commonly found in European markets, and to a limited extent in some of the larger markets of the United States.

Chards are commonly produced only from the globe artichoke plants in an old plantation that are about to be destroyed. After the best of the buds have been cut from the old plants the stems are cut down as close as possible to the ground and the leaves are cut off to within 6 inches of the ground. Each plant is then covered with from 12 to 18 inches of a straw litter; some growers make the litter 24 inches deep. The new stalks and leaves that come up through this litter develop in the dark and are of a cream-white color. The new growth is commonly cut when it is about 12 inches long; it is probably most tender up to this point. Some growers allow it to grow to a height of nearly 24 inches before cutting it; in this way they get a larger production at the expense of quality.

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### HARVESTING AND MARKETING

73. **Harvesting.**—The time for harvesting globe artichoke buds is regulated by their stage of development. They are edible any time before they begin to open. When the blue florets begin to show out of the top of a bud it has become too old and woody for eating.

For pickling, the buds are often cut when they are from one-third to one-half grown. They are commonly allowed to

reach a size of 3 to 5 and sometimes 6 inches in diameter before being cut for market.

The buds should be cut with a stem about 2 inches long; they should be carefully handled to prevent bruising. As soon as the head is cut the remainder of the stem should be cut off close to the root in order to encourage the development of new suckers before cold weather.

Immediately after being cut the buds should be wrapped in paraffin paper and carefully packed in boxes or baskets to prevent them from being bruised during shipment.

**74. Marketing.**—Many globe artichokes are annually imported into the United States from Europe, principally from Belgium, and bring high prices in some of the big city markets. Some of the truck growers of the extreme South and some in Southern California are now growing this vegetable successfully, but the demand has not yet been oversupplied. The commercial production of the crop in some sections of the North has not been successful, although it can be grown there in home gardens. Most of the present home-grown supply comes from the two sections mentioned.

Globe artichokes bring a big price on the market, but the high prices have limited their use to such a comparatively few persons that any great increase in the supply would undoubtedly have to be sold at a considerable discount, and possibly could not be marketed at a profit. In the large markets the range in price is from about \$1.50 to \$5 a dozen buds. A few seasons of lower prices would no doubt greatly widen the market for globe artichokes and in the end might prove beneficial.

## JERUSALEM ARTICHOKES

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### GENERAL REMARKS

**75.** The *Jerusalem artichoke* belongs to the same general family, the aster family, as the globe artichoke, but it is more closely related to the sunflower branch of this family, and is entirely different from the globe artichoke in its appearance and in the character of its edible parts. The *Jerusalem artichoke* is a hardy, tuberous perennial that somewhat resembles the sunflower plant. The edible part is the tuber, which is smaller than the average-sized potato tuber and much more irregular in shape. The *Jerusalem artichoke* is a native of Canada and the central parts of the United States, and some authorities claim that it is also a native of Brazil. The Indians cultivated it in America long before the advent of the white man; it was first introduced into England early in the 17th century. In Europe it was formerly extensively cultivated as a garden vegetable until it was largely displaced by the white potato. It is still grown there to a considerable extent, but there is little demand for it in America.

**76.** The *Jerusalem artichoke* plant is likely to become a weed in waste places or in poorly cultivated fields. When no pains are taken to subdue it, it spreads rapidly, and an occasional cultivation in a field, because of the division of the tubers, will do more to spread it than if the ground is left alone; new plants will come from each of the pieces of cut tubers. Thorough tillage, which will prevent the tops from growing is one of the most effective ways of subduing the crop as a weed. If the ground is plowed in the fall, many of the tubers can be picked out and taken away. One of the simplest methods of eradication is to turn swine loose in the field; these animals will very thoroughly root out and eat the great majority of the tubers.

**77.** The tubers of the Jerusalem artichoke are nearly as nourishing as those of the white potato. They are of a moist, soft texture, and of a fairly agreeable taste. They are eaten boiled and mashed with butter as a substitute for white potatoes, and boiled and cut up in salads. Some persons pickle them in vinegar.

An important use for Jerusalem artichokes is as a stock feed. Almost all farm animals are fond of them. They are liked by cattle, swine, and sheep.

When ground up and fed in connection with grains they form a suitable food for poultry. This vegetable is important for feeding to stock because such a large quantity of the tubers can be secured from a small area at a low cost, and because they do well on poor soils.

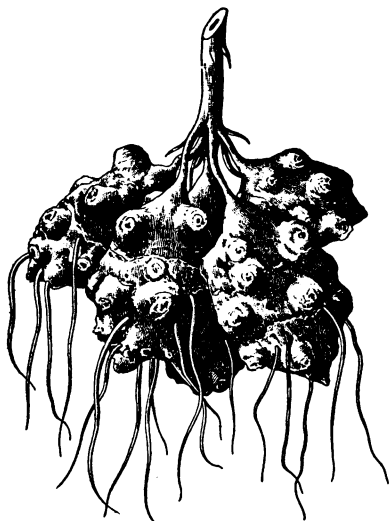


FIG. 11

**78. Varieties.**—There are no named varieties of the Jerusalem artichoke commonly listed by American seedsmen; the vegetable is simply listed as Jerusalem artichoke. The Mammoth White French is an improved

strain of the common Jerusalem artichoke.

**79. Propagation.**—The Jerusalem artichoke is propagated by means of the tubers, like the white potato. New plants will grow from either whole or cut tubers, provided the cut pieces contain at least one eye. The perennial habit of the plant is due to the fact that new plants will spring up from the tubers that remain in the ground over winter. The tops are killed by frost. Tubers of the common Jerusalem artichoke are shown in Fig. 11.

### CULTURE

80. Jerusalem artichokes are hardy and will do well under a wide variation of climatic conditions. They will also do well on almost any soil but will yield enormous crops on rich, well-drained soil; the heavier soils are usually considered somewhat superior to the lighter ones for this crop. Jerusalem artichokes can be grown on soils that are too poor to grow anything else, but under suitable conditions they will yield far more than white potatoes; yields of 500 to 1,000 bushels per acre have been secured on good soils; the cost of production is also less than for white potatoes. Jerusalem artichokes should be planted in an open exposure, where they will get plenty of sunlight. They are as easily grown as corn and white potatoes.

The soil should be plowed from 5 to 6 inches deep and should be thoroughly harrowed as for white potatoes.

81. Jerusalem artichokes should be planted early in the spring; early planting is essential to secure large yields. The small tubers may be planted whole, and the larger ones may be cut into pieces having one to three eyes, like white potatoes. The rows should be spaced from 3 to  $3\frac{1}{2}$  feet apart, and the hills from 15 to 18 inches apart in the row; at these distances from about 11,600 to about 8,300 hills can be set per acre; spacing the rows 3 feet apart and placing the hills 18 inches apart in the row, or planting about 9,680 hills per acre is usually satisfactory. The rows should be run north and south so as to admit all the light possible to the plants. The seed pieces should be planted about 4 inches deep.

Some growers plant Jerusalem artichokes in an out-of-the-way spot on their farms where there will be no need to give them much care or to bother about them becoming a serious weed pest. In such a spot the plants grow at will and the farmer merely digs the crop when the tubers are large enough. A few tubers are usually left in the soil after the crop has been dug and these are ample to furnish plants enough for the

following year. Large yields are not possible in this method of culture, but under some circumstances it has its advantages.

82. When Jerusalem artichokes are planted and tended like a regular farm crop, the ground should be tilled frequently enough to keep it free from weeds, and toward the end of the season when the plants have made a good growth, they should be hilled up a few inches to keep the tubers from breaking through the ground as they develop.

83. Although Jerusalem artichokes do well in most soils without fertilization, they will respond surprisingly well to moderate applications of fertilizer, and the largest yields are secured in this way. They respond particularly well to application of potash and lime. The method of fertilization recommended for the white potato is suitable for this crop.

84. The claim has been made by some growers that the size of the tubers, and hence the yield of the crop, can be greatly increased if the tops are cut back about one-half in August. The evidence to support such a claim, however, is lacking. The logical result of depriving the plants of such a large part of their leaf surface would be greatly to weaken them and reduce the size of the tubers.

85. No insect pests or fungous diseases are troublesome on Jerusalem artichokes. As the plants are such vigorous growers, any minor injury done by such pests has little effect on the yield.

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#### HARVESTING, STORAGE, AND MARKETING

86. **Harvesting.**—Jerusalem artichokes require the entire growing season from early in the spring until late in the fall to produce their largest yields. The tubers are ready for digging in the fall after the frost has killed the tops or when the foliage has matured and shows signs of dying.

On a small scale, the plants may be pulled up bodily and the tubers picked off of them. They may be harvested more conveniently, however, by the use of a spading fork or a potato

hook. The larger potato diggers may also be used for this purpose. If the tubers are to be fed to hogs, the animals may be turned into the patch and allowed to dig them up for themselves.

When the piece of ground is to be used for other crops the following year, care should be taken to dig up all of the tubers. If any small pieces are allowed to remain in the soil, they will form new plants the following spring, because they vegetate very readily.

**87. Storage.**—The simplest way to store Jerusalem artichoke tubers is to leave them in the ground over the winter. They are perfectly hardy and are not injured by this exposure if they are kept covered with a few inches of soil. If the tubers have already been gathered, they can be stored in pits like beets, turnips, carrots, and other root crops; they will carry over the winter with less protection than these crops.

**88. Marketing.**—There is little demand for Jerusalem artichokes in the American markets, and the quantity that can be sold in any one market is necessarily very limited, and the comparatively high prices at which they are sold operate to discourage the majority of persons from trying them. If their value was more generally known and the market price was reduced they would probably be much more generally used as food.

The tubers are commonly sold by the bushel, and bring from 75 cents to about \$1.50 a bushel at wholesale in the markets where there is a demand for them. In most markets they cannot be sold at any price.

## SEA KALE

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### GENERAL REMARKS

**89.** *Sea kale* is a hardy perennial herb of the mustard family. It is grown to some extent in Europe for its young shoots, which are usually eaten blanched, but it is little known in America. The plant grows wild on the seacoast of Southwestern Europe.

The leaves of the plant are large, somewhat resemble a cabbage leaf, and are covered with bluish-white bloom. The plant throws up a strong flower cluster, which bears rather showy, rich, white flowers that have a honeyed smell. The plant is an attractive ornament early in the season, but is seldom used for this purpose. Sea kale has probably been cultivated in gardens for more than 150 years. European peasants who live along the seacoast have from time immemorial gathered the shoots of the sea-kale plant as they pushed their way up through the sand on the beach and used them as boiling greens. Although the plant is little known in the United States, it is worthy of more general cultivation because it supplies a succulent food of excellent quality early in the spring when fresh vegetables are scarce.

**90.** The young shoots and leaf stalks are the edible parts. These are eaten while they are young and tender, which is before the leaves have unfolded. The flavor of these parts is somewhat like a combination of the flavors of asparagus and celery. The blanched shoots and leaf stalks are cooked and served like asparagus. The stalks are also cooked with the leaves and served as greens. The blanched product is also used in soups and salads.

As this vegetable is ready for use in the spring before asparagus, it is a welcome addition to the table at a time when fresh vegetables are scarce.

**91. Climatic Requirements.**—Sea kale is hardy in most parts of the United States. It is a native of a cool climate, growing wild on the seacoast of Britain and of Western Europe, but seems to do equally as well in Georgia as in the latitude of New York City. Good moisture conditions, both in the air and soil, are conducive to good success with this plant.

**92. Soils.**—The soil in which sea kale succeeds best in cultivation is a deep, fertile, rather moist sandy loam. The soil in which sea kale grows wild is the deep sand along the seacoast that is mixed with refuse from the sea. The abundance of water in such a location obviates the necessity of a high humus content, but in inland locations where water is not so abundant, an abundance of humus is necessary to hold sufficient water. Leaf mold or well-rotted stable manure are suitable for supplying humus. A deep soil is necessary on account of the long tap root developed by the plant. Much of the luxuriance of growth of the plant depends on planting it in the proper soil. Sea kale will maintain a vigorous growth for a number of years only on a strong, moist soil.

The location for sea kale should be open and exposed to all the sunlight possible, as is the case on the seashore.

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## VARIETIES AND PROPAGATION

**93. Varieties.**—Named varieties of sea kale are not commonly listed in American seed catalogs, but the vegetable is simply listed under the heading of sea kale. In Europe one of the most prominent varieties is the **Sutton White Ivory**.

**94. Seed and Seed Production.**—Sea-kale seeds are not single like most vegetable seeds, but are really fruits, or pods, similar to beet seed, and each fruit may produce from two to three plants. Usually, the fruits are sown without shelling out the seed. The seed is large and rather bulky. From about 425 to 510 weigh 1 ounce; 1 quart weighs a little more than 8 ounces. A sample of sea-kale seed is shown, natural size, in Fig. 12.

The seed is slow to germinate. Usually, the seedlings will not appear above ground until about 3 weeks after they are planted, and in extreme cases they will not appear for 4 or 5 months. If the outer coating of the fruit is bruised without injuring the seed inside, the time required for the seedlings to appear will be greatly shortened.

From 5 to 6 pounds of sea-kale seed are required for sowing 1 acre, and about 2 ounces are required for sowing about 100 feet of drill. In pound lots, sea-kale seed commonly retails for about \$1 a pound.

Seed production is very simple. A few good plants should

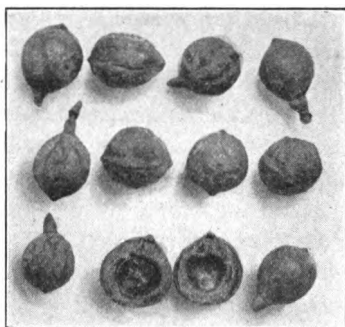


FIG. 12

be selected for this purpose during the summer and marked. The next spring these should not be cut from nor blanched, but should be allowed to grow as they will and to run to seed. The production of seed will greatly weaken a plant and it will not produce good crops of shoots thereafter. Large quantities of seed are produced by a single plant, and from six to

two or three dozen plants will usually supply enough seed for the home use of almost any grower.

**95. Propagation.**—Sea kale can be propagated by means of seeds and by root cuttings. Plants from seeds will be ready for cutting in about the third year of growth. Some persons claim that the plants produced from seed are better than those produced from root cuttings, but there seems to be no good evidence to support this statement; propagation from seed is less often practiced than propagation from root cuttings, because a year longer is required before the plants are ready for cutting, and the care and the expense is greater.

Seedlings are raised in a seed-bed and transplanted to their permanent places in the field when they are 1 year old. The seed should be sown in well-tilled fertile soil. In especially hot

localities, it is best for the seed-bed to have some shade from a fence, building, etc., during the heat of the day. The seed should be sown very early in the spring in order to get all the growth possible the first year. Beds about 4 feet wide should be raised 3 or 4 inches above the surface of the field, and the seed should be sown thinly on these in drills about 12 inches apart. On account of the slowness with which the seed germinates, patience must be exercised, and the bed should not be neglected if the seedlings do not show in 3 or 4 weeks. The seed-bed should be liberally watered during dry weather, and all weeds should be kept down.

When the seedlings are 1 or 2 inches high they should be thinned to stand about 1 inch or so apart in the row, and later they should be thinned to stand from 2 to 3 inches apart, in order that they may have ample room for development.

When the leaves of the seedlings die down in the fall they should be cut off and earth ridged up over the crowns about 2 inches deep. This should be covered with straw or leaves to a depth of about 4 inches. So handled, the young plants will keep over the winter in good condition. They should be transplanted to their permanent places in the spring as early as the soil can be prepared for them.

The more common method of propagation is by root cuttings, principally because it is much quicker; if a good growth is secured, some shoots may be cut from such plants the next spring after they are set out, but usually better results will be secured by not cutting them until 2 years from starting. The cuttings should consist of pieces of strong roots from 4 to 6 inches long and should be taken from the plants as early as possible in the spring. They may be transplanted directly to the field where they are to stand permanently, but better results are usually secured by growing them in a seed-bed for 1 year; this is because they are more likely to receive better care in a seed-bed than in the field.

### PLANTING AND GENERAL MANAGEMENT

**96. Planting.**—The soil should be deeply prepared for sea kale, in order to give the long tap root of the plant an opportunity to strike deeply into the ground. The soil should not, however, be dug up so deeply that the subsoil will be mixed to any extent with the top soil. One advantage of selecting a soil about 2 feet deep is that it can be dug deeply without danger of this mixing. Sea kàle should never be planted in the shade of trees or where the tree roots will deprive the plants of moisture.

The plants should be set in the field as early as possible in the spring. They should be taken up carefully from the seed-bed with a trowel, so as not to disturb the roots any more than is necessary. Special care should be taken to see that the roots are not carelessly broken, and that they are not injured by exposure to the wind and sun.

The distances for planting sea kale in the field vary somewhat in different localities. The common way is to set the plants on the level ground in rows from 2 to 3 feet wide and to space them about 2 feet apart in the row; this will give from about 10,890 to 7,260 plants per acre. One grower claims to get the best results by growing the plants in raised beds; he makes beds 3 to 4 inches high and 3 feet wide, with alleys 2 feet wide between them, and then plants two rows of plants 18 inches apart on each bed and spaces the plants 18 inches apart in the row. Other growers claim that the plants should be set as far apart as rhubarb, that is, from 3 to 4 feet apart each way, but this is more than is required and is wasteful of space.

The plants should be set at the same depth that they stood in the seed-bed. When root cuttings of old plants are being set, it is sometimes advisable to plant two cuttings in each place in order to insure the growth of at least one plant; if both grow, the weaker should be cut out.

**97. General Management.**—During hot, dry spells of the first season in the field the plants should be artificially watered if the soil shows a marked tendency to dry out. This

is important, because the abundance of the growth secured the first season has an important influence on the productivity of the plants in later years.

The soil should be kept well cultivated and free from weeds.

Fertilization as recommended for rhubarb will be found suitable.

Each fall the plants should be mounded up with earth and covered with a straw mulch. The plants are hardy and will

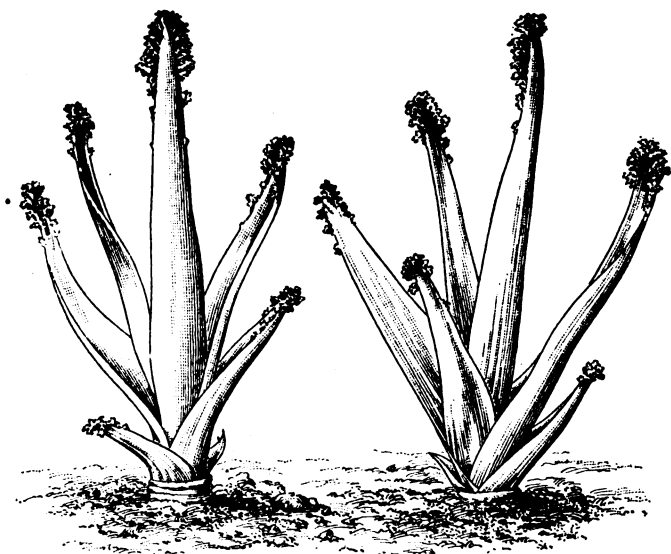


FIG. 13

usually live over the winter without such a mulch, even in the northern parts of the United States, but they will yield larger crops when so handled.

Larger stalks can be secured if all the suckers but four or five of the best ones spaced at regular intervals around the stem are thinned off in the spring shortly after growth starts.

98. The young shoots are greatly improved by blanching, and this is commonly done. Sea kale of the best quality can be blanched with large clay pots; these are inverted over the plants, the holes in the bottom stopped up, and the shoots

allowed to grow in darkness; on account of the expense, this is practicable only on a small scale. Inverted wooden boxes may also be used. If a considerable area of sea kale is to be blanched, the plants are usually covered to a depth of 12 to 15 inches with straw or leaves, and the shoots cut off as they begin to break through. This method of blanching is similar to that practiced on rhubarb. Other growers ridge fine, loose earth over the crown of the plants; a fine clean sand does well for this purpose; the soil should not be of such a nature that it will stain the shoots.

When blanched, the leaves of the plants do not develop but grow as shown in Fig. 13.

**99.** Sea-kale shoots should not be cut later than June. After this time the plant should be allowed to grow its tops so that energy can be stored up in the roots for the production of a crop the following spring. The blanching medium should be taken off late in the afternoon and preferably during a spell of cloudy weather so that the blanched parts of the plants will not be too suddenly exposed to the sunlight.

**100.** Sea-kale plants may be forced outdoors in hotbeds or by covering them in the field with barrels or boxes banked with fermenting manure. They may also be forced indoors like rhubarb. It is possible that if sea kale ever becomes a popular market crop that the most profit can be obtained from it by forcing it indoors during the winter.

**101.** Sea-kale plants that are intended for the further production of shoots and leaves in the spring should not be allowed to go to seed, because seed production greatly weakens the plants. This will greatly impair the crop of the following year, and will also have an effect on all subsequent crops.

**102.** On strong soils, and when they have good care, sea kale plants should maintain a vigorous growth and produce abundant annual crops for 5 to 8 years after they come to cutting age. After this time they begin to show a decline in vigor, and the old plants should be taken out and new plantings made.

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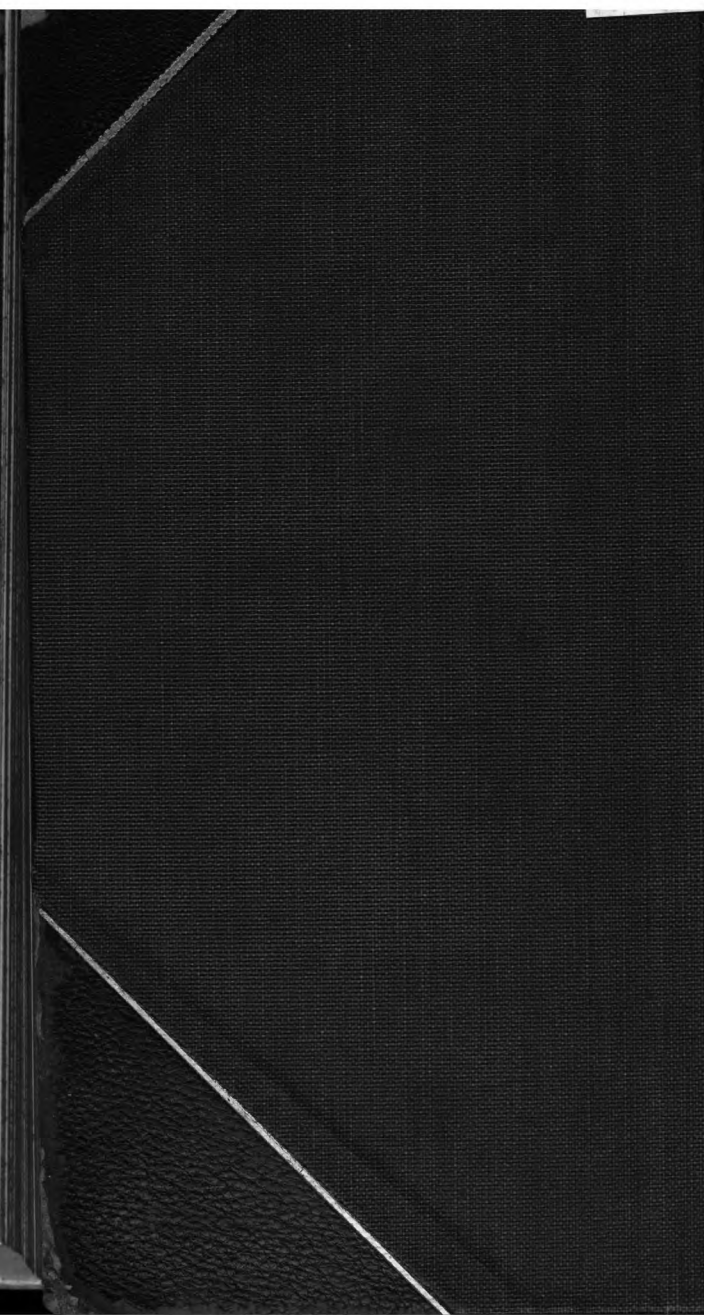














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